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TROPICAL DISEASES BULLETIN

Vol. 2. 1913. No. 5.

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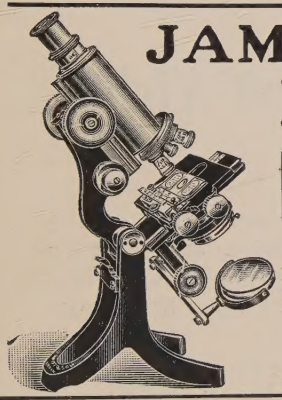

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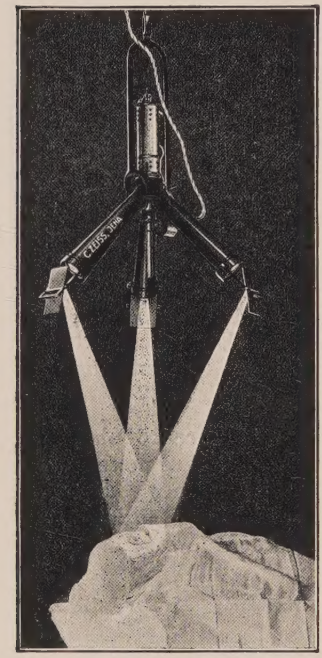

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TROPICAL DISEASES BUREAU.

TROPICAL DISEASES BULLETIN.

Vol. 2.] 1913. [No. 5.

MALARIA.

Epidemiological and Clinical.

Leger (Marcel). **Le Paludisme en Corse. Recherches Microbiologiques. Etudes Prophylactiques.**—*Publication de l'Institut Pasteur.* 1913. 60 pp. With 2 maps and 7 tables. (Laval: L. Barneoud et Cie., Imprimeurs.)

Malaria in all its forms is the principal disease in Corsica. It is responsible for the loss of over 1,000,000 days of work yearly. In the village of Pietra di Verde four-fifths of the inhabitants were found to be infected. The case incidence varies in different parts of the island and the disease varies in intensity in the different months of the year. The East Coast is unhealthy over all its extent from Bastia to Bonifacio, and there are scarcely any privileged places in the whole island where the disease is exceptional. It is common along the courses of the rivers. Ponte-Lecia on the river Golo, 40 kilometres inland and 200 metres above sea level, is very malarious; even Corti in the very heart of the island situated at a height of 500 metres is not exempt. Important malarial foci also exist at the mouths of certain streams on the West Coast at Saint-Florent, Galvi, Ajaccio, Porto-Pollo and Pianottoli. The primary attacks of fever occur in June and increase progressively in number in July, August, September and October. The disease diminishes in November and is exceptional from December to May.

The author gives a detailed account of his investigations regarding the breeding places of Anophelines in the island, and the parasitic and splenic indices of the inhabitants. In the months of May and June, out of a total of 1,031 people examined, the parasitic index in the blood was 7·56 per cent., the majority of the cases being benign tertian. The spleen rate was 28·8 per cent. During the hot months of July, August and September, the blood index was 16·49 per cent. and the spleen rate 42·17 per cent. Benign and malignant tertian cases, during these months, were equally common and quartan also occurred. After the hot season

in November, the blood index fell to 6·5 per cent. and the spleen rate to 31·95 per cent.; during this period malignant tertian was most prevalent.

In the second part of his report the author describes the anti-malarial measures carried out. He states that the usual method adopted in Corsica in the struggle against malaria is a general exodus of the peasants and tradespeople from the plains into the mountains during the hot months. During their stay in the mountains they are badly housed and very badly fed, and spend the entire savings of their year's work. This migration from the plains commences in June and they return again towards the end of September, or later if their resources can hold out. In spite of this they do not escape malarial infection. A Corsican anti-malarial league has for some time been established to educate the people in the part played by mosquitoes in the disease. Prophylactic quinine has been given and a few houses have been mosquito-proofed. These endeavours have been attended with some success; but an enormous amount still remains to be done. The author advises as to what further measures should be adopted.

In the third part of the report the results obtained by systematic quinine prophylaxis are described. During the summer of 1912 a number of quinisation areas were established in order to prove to the peasants that it was possible to withstand the dangerous season without migrating into the mountains, by taking regularly small doses of quinine salts. He describes the results obtained in five different areas. In the area of Casabianda the blood index in May was 42·85 and the spleen rate 57·14 per cent. Among those who were given quinine the blood index fell to 9·09 and 7·14 per cent. in August and November respectively and the spleen rate fell to 9·09 and 7·14 per cent. The quinisation was commenced on the 10th of June. Each person received daily 0·2 grammes of quinine bichloride. To children under 5 years were given chocolate tabloids containing 0·15 grammes of the drug. This medication was continued till the 15th day of October.

[The report is a very excellent one and those wishing for further information should consult it.]

D. Thomson.

Sergent (Edmond & Etienne). **Etudes Epidémiologiques et Prophylactiques du Paludisme. Neuvième et Dixième Campagnes en Algérie, en 1910 et 1911.**—*Ann. Inst. Pasteur.* 1913. May 25. Vol. 27. No. 5. pp. 373-390.

The authors state that malaria was much less severe in 1910 than in 1909 in Algeria, but more severe again in 1911. In a number of places malarial epidemics occurred, especially in Mitidja. In the valley of the Seybouse the malarial season lasted until April 1912. In 1911 mosquito breeding pools were more abundant and persisted longer than in the preceding years, as a result of the rains in the spring time continuing longer than usual. The summer of that year was extremely hot and prolonged. Extensive land excavations during

the construction of defence works may also have accounted for the increase of malaria in 1911.

In 1910 the spleen rate was 16·9 per cent. in a total of 3,847 persons examined, and parasites were found in the blood of 8 cases out of a total of 52 examined. In 1911, the spleen rate was 23·5 per cent. (3,570 persons examined) and 19 out of 50 cases presented parasites in their blood. In spite of the increase of malaria in 1911, it was not found that blackwater fever was more prevalent during that year.

Regarding the antimalarial work in progress, they state that the antilarval measures, commenced in 1909 at Montebello and other localities, have given excellent results. These measures consisted in filling in and drainage. Adult mosquitoes are destroyed in dwellings by the combustion of simple pyrethrum powder. Mosquito traps are used and good results have also been obtained by alcohol vapour. Quinine has been given prophylactically by three different methods: (*a*) daily doses of 20 centigrams; (*b*) doses of 60 centigrams every three days; (*c*) doses of 60 centigrams every six days. Children receive smaller doses in proportion to age. All these methods have given appreciable results in reducing the spleen rate. The first apparently gave better results than (*b*) and (*c*). The bihydrochlorate of quinine is employed, in tabloid form. Three thousand people are given quinine regularly every year by the quinine dispensers. The quinisation has been confined to certain demonstration areas and to localities where malaria is especially severe. In 1910 and 1911, sixteen quinine dispensers (European) were employed—eleven men and five women. Six teachers have administered quinine to the children in their schools in the springtime and autumn.

Every year the number of mosquito proof dwellings is increasing and a considerable amount of literature regarding the prevention of malaria is distributed amongst the inhabitants. In the demonstration areas good results have been obtained. In 1910 at Montebello the number of protected Europeans was 78. Among these there were no cases of primary infection and very few relapses in those who had already suffered from malaria. Among those who were not protected malaria increased and there were at least 16 cases of primary infection. In 1911 similar results were noted.

At Mondovi in 1910 there was no case of primary infection in 800 protected Europeans and only one case of mild blackwater fever in a patient who had previously suffered from malaria. Out of 362 unprotected Europeans there were two severe cases of blackwater fever. 1911 (Mondovi), 900 protected Europeans —2 primary infections and 3 severe cases of blackwater fever in 3 children who did not receive quinine. Among 400 unprotected Europeans—six severe cases of primary infection.

Tourville, 1910, 1,000 protected Europeans,—no case of primary infection. Unprotected,—2 cases of primary infection

out of 4 persons. 1911, 1,000 protected Europeans,—no cases of primary infection. Unprotected,—8 cases out of 100 persons.

Sainte Leonie, 1910, 300 protected Europeans,—no cases of primary infection. Unprotected,—2 cases in 4 persons. 1911, 300 protected Europeans—no cases of primary infection. Unprotected—2 cases in 4 persons.

In 1910 and 1911 850 kilogrammes of quinine tabloids were distributed for prophylactic and curative purposes.

D. T.

O'Connell (Matthew D.). **The Meteorology of Malaria.**—*Jl. Trop. Med. & Hyg.* 1913. June 2. Vol. 16. No. 11. pp. 165-166.

The author maintains that the atmospheric conditions at Puttalam and at Kurunegala in Ceylon during October are somewhat similar as regards humidity and temperature to the conditions in the Lancashire cotton sheds. Since it has been shown that the body temperature of workers in the latter are raised above normal, he thinks that the atmospheric conditions in the former must necessarily raise the temperature of the inhabitants to about 100° F. He considers that such a state of affairs is conducive to an outbreak of malaria.

D. T.

James (W. M.). **Notes on the Etiology of Relapse in Malarial Infections.**—*Jl. of Infectious Diseases.* 1913. May. Vol. 12. No. 3. pp. 277-325. With 1 coloured plate.

The author asserts that a considerable part of the malaria in the Panama Canal Zone is due to relapses. It has been shown there that the increase in the amount of malaria at the beginning of the wet season is out of proportion to the increase in the number of Anopheles mosquitoes. This shows a relationship between exposure to wet and chilling and the increase in the malaria rate. The wet and chilling no doubt bring on relapses. Relapses are more liable to occur in aestivo-autumnal than in benign tertian infections; but they are most frequent in quartan malaria. Relapses have followed every method of giving quinine, though in varying proportions, and until the true cause of relapse is known the treatment of malaria will remain to some extent empirical and imperfect.

The hypotheses as to the cause of relapse fall under two heads:—(1) That it is due to the development of a resistant and latent form of parasite different from the asexual type. This peculiar form in conditions not clearly understood transforms itself into the asexual type and begins a relapse. This hypothesis includes the theory of parthenogenesis in the female gametes as advanced by Cannalis, Grassi, Maurer, Neeb, Schaudinn, and Harrison. Craig hold that relapses are due to a resistant form of parasite formed by the conjugation of two young asexual forms and states that this resistant type

can under certain conditions split up into asexual parasites. EWING also believes in the existence of conjugation forms. (2) That relapses are due to the ordinary asexual parasites. After treatment, or spontaneously, these parasites may disappear, but the disappearance is only apparent; a few of them, not numerous enough to be detected, remain and continue their cycle. Under certain conditions these few are able to increase in number until the clinical symptoms of relapse are manifested. This hypothesis has the support of ROSS, THOMSON, and BIGNAMI.

With regard to the first hypothesis very few observers have ever seen parthenogenesis or the so-called resistant forms, but the fact that gametes are very resistant to quinine favours the belief that these by reverting into the asexual form may cause relapses. In spite of the search for parthenogenesis by many competent observers there is still very limited evidence that such a process occurs. BIGNAMI, FÜLLEBORN and the author believe that the so-called parthenogenetic forms seen and described by SCHAUDINN and others are merely atypical sporulating asexual parasites such as are seen in anaemic blood and during quinine treatment. At any rate after a careful examination of the data it cannot be held that parthenogenesis is an established fact, and there is still less evidence to show that this supposed phenomenon is the cause of relapses. THOMSON has shown that individual gametes do not persist for long periods in the blood. The continual persistence of gametes means that the asexual cycle which produces the gametes is still going on. So that when gametes persist day after day it is certain that an asexual cycle is simultaneously pursuing its development, perhaps in the internal circulation.

With regard to the second hypothesis, MARCHIAFAVA and BIGNAMI maintained that relapses at short intervals could best be explained by assuming that a certain number of the parasites survived quinine treatment and the action of the protective forces of the body. This statement however received no scientific support until ROSS and THOMSON by use of the "thick film" method were able to show that although the usual method of blood examination might, and very frequently did, fail to show parasites in the apyretic interval between relapses, in the thick films the organisms could be demonstrated in some cases during the entire interval. They also found that relapses so produced had no relation whatever to gametes or "resistant forms," but depended entirely on the degree to which the asexual parasites resisted quinine or the protective forces of the body. These facts are not accepted by CRAIG, DEADERICK and HENSON as explaining long interval relapses. BIGNAMI, however, after a careful examination of the claims made for a "resting stage" of the parasite, concludes that there is no basis for such claims. He argues from the view-point of analogy and biology that relapse is due to the persistence of the asexual cycle. The asexual parasites become immune either to the effect of quinine or to the protective forces of the body, just as EHRLICH has shown occurs in the case of trypanosomes with regard to atoxyl

and other drugs. He concludes that this immunity whether against quinine or against the protective forces of the body, will explain any case of relapse, whether at long or short intervals.

The author shows in detail how the known facts regarding relapse can best be accounted for by the second hypothesis. Parthenogenesis will not explain why triple quartan and double tertian infections relapse as such. It has been shown that the gametes do not live indefinitely. Relapses have been recorded after an interval of two years and there are certainly no facts to show that a gamete can persist for that length of time. The author believes that CRAIG's so-called "conjugation" forms of parasites are forms of developing crescents. The forms described by CRAIG undoubtedly exist but he has misinterpreted their meaning. There is a widespread belief that there are two kinds of relapses—one due to a simple renewal of vitality at short intervals, without further change of the asexual generation; and the other to a renewal of vitality at long intervals of some "resistant" or "latent" form, derived from the asexual cycle. The author however believes that there is but one primary cause of relapse, a renewal of vitality on the part of the asexual cycle, and that this is true, whether relapse takes place a week or a year after the original infection has subsided. The asexual cycle can persist over long periods, even two years, in the human host, though at times in numbers too small to be detected. This assumption seems quite reasonable, since other protozoa such as *Leishmania*, *Trypanosoma* and *Entamoeba* can also live in the human host for years. These infections are apparently maintained solely by the persistence of organisms that correspond to the asexual cycle of *Plasmodium*. CALKINS and WOODRUFF have shown that free living protozoa such as *Paramoecium* can reproduce themselves for many generations (over 3,000) without necessity for parthenogenesis or for conjugation. There is no reason why the asexual cycle of the malarial parasite should not persist for a time equal to the longest recorded interval between a primary infection and a relapse, *viz.* about two years. Malarial parasites of the asexual cycle may become immune to the protective forces of the body and ROSS and THOMSON, BIGNAMI, MOLLOY and others have shown that they may also develop a considerable resistance to quinine. The author has observed that the asexual parasites can be found in the spleen and bone marrow long after they have apparently disappeared from the peripheral blood. Possibly in these organs they are more able to resist the action of quinine.

It has been found from the large clinical experience obtained in Ancon Hospital that fewest relapses follow the treatment instituted by DEEKS, *viz.* 15 grains of quinine thrice daily by mouth for two to three weeks. This treatment resulted in fewer relapses than the previous treatment of 10 grains thrice daily. Treatment by intravenous injection is apparently the most certain of all. [This is an important paper and those interested should consult the original.]

D. T.

BATES (John Pelham). **A Review of a Clinical Study of Malarial Fever in Panama.**—*Jl. Trop. Med. & Hyg.* 1913. June 16. Vol. 16. No. 12. pp. 177-184.

This is a continuation of the paper summarised in this *Bulletin*, Vol. 2, p. 150, and deals with the symptoms and differential diagnosis of malarial fever.

The author believes that there are two species of malignant tertian parasites to which he applies the term *Plasmodium falciparum subtertianum* and *P. quotidianum*. He does not believe that there is an nonpigmented form of the latter. *P. falciparum subtertianum* shows pigment early in its development. The pigment is coarse and granular, rather dark in colour, nearly always remains more or less aggregated, and occupies usually an eccentric position in the cytoplasm. The parasite does not attain the full size of its erythrocyte host; and in many instances shrinks and distorts the red blood cell to quite a considerable degree, producing the so-called "brassy bodies." *P. quotidianum* shows pigment late in its development. The pigment is in small granules, brownish in colour, and is usually disseminated throughout the cytoplasm until just before sporulation occurs, when it becomes aggregated about the centre of the organism. The parasite attains nearly or quite the full size of its erythrocyte host.

He describes at length the various signs and symptoms met with in malignant tertian malaria. He states that albuminuria is quite a common feature in malaria. Of 200 cases he found it in 42 per cent. In pernicious cases albumin and casts of various kinds are quite common. In all grave pernicious fevers hæmoglobin can be found in the urine if Brem's test be employed. Algid and choleraic types of pernicious malaria have been extremely rare in Panama. The author has seen one algid case, and one case of the choleraic form has been reported. He believes it is likely that these forms of malaria are due to a concomitant attack of heat-exhaustion as the symptoms are very like those of the latter disease. He does not believe that there is a true dysenteric type of malaria and maintains that the so-called dysenteric forms of malaria are simply cases of malaria complicated with true dysentery. Regarding the diagnosis of malaria he states that a fever which continues for more than five days unchecked by quinine is not malaria.

D. T.

ATKINSON (J. M.). **A Clinical Test for Malarial Fever.**—*Lancet.* 1913. June 28. pp. 1802-1803.

The author draws attention to SCHLESINGER's reaction for demonstrating the presence of urobilin in patients suffering from malarial fever. The test is as follows:—

Fill a test tube one-third full with unfiltered urine and add an equal quantity of Schlesinger's solution (zinc acetate one part, alcohol ten parts) which has previously been well shaken; then drop in a few drops of weak solution of tincture of iodine—this

accelerates the reaction. The mixture is then filtered and, if urobilin be present, shows a more or less distinct fluorescence.

The reaction is met with in the urine of patients suffering from all types of malaria and in cases of malignant malaria it may even be obtained after diluting the urine with 200 parts of water. A healthy urine does not give the reaction as it contains only the slightest amount of urobilin, but other diseases such as cirrhosis of the liver, abscess, and many infectious maladies also exhibit it so that the test cannot be described as specific. On the contrary, as the author points out, its absence speaks strongly against acute malarial fever, a fact of great value when a quick diagnosis has to be made.

G. C. L.

HAMMOND (F. A. L.). **Malarial Gangrene.** [Mirror.]—*Indian Med. Gaz.* 1913. June. Vol. 48. No. 6. p. 228.

The author describes two very interesting cases of moist gangrene occurring in native patients suffering from severe attacks of malignant tertian malaria. On admission to the hospital both patients were in a state of collapse with subnormal temperature.

Case 1, Hindoo male, aged 19, showed a very heavy infection of malignant tertian malaria. One in every three corpuscles contained parasites. Stimulants were administered and quinine grs. 10 was injected hypodermically each day. On the 5th day it was noticed that the skin over both calves was becoming dusky in patches, which spread rapidly over the whole surface of the leg. In spite of all precautions moist gangrene became three days later fully established in both lower extremities. The right leg had to be amputated at the knee. The left foot subsequently sloughed. There was no history of syphilis in this patient. He eventually recovered.

Case 2, Mahommedan, male, aged 25, had had fever for 8 days before admission. His pulse was imperceptible, and the whole body was cold and clammy. In spite of every effort to improve his vitality by brandy, adrenalin, strychnine, digitalis, and the intravenous administration of quinine, he developed gangrene of all four extremities, which rapidly became moist and septic. He died fourteen days after admission, having developed oedema of the lungs.

D. T.

NICHOLLS (Lucius). **Cirrhosis of the Liver of Malarial Origin.**—*Jl. Trop. Med. & Hyg.* 1913. June 2. Vol. 16. No. 11. pp. 164-165. With 1 plate.

The author states that cirrhosis of the liver is a common condition in many tropical countries, and numerous authorities have asserted that some cases are caused by repeated attacks of malaria; this however has been disputed, and at the present time

there appears to exist much doubt that malaria is ever a cause of the condition. In the author's opinion a type of monolobular biliary cirrhosis does arise from repeated attacks of malaria. The production of this cirrhosis depends upon the presence of adhesions and enlarged glands in the transverse fissure of the liver and thickening of the fibrous capsule. The sequence of changes appears to be:—1. The formation of adhesions, and enlargement of lymphatic glands, which press upon the bile-ducts in the transverse fissure; (2) The swelling of the liver at each attack of malaria; (3) As the adhesions and perihepatitis increase, the organ is held as in a vice, and the hepatic enlargement must take place against considerable pressure; (4) There is therefore increased internal pressure in the bile ducts and gall bladder; (5) Malarial toxins are formed in the liver, and these being excreted under unusual pressure along the bile ducts, result in the formation of fibrous tissue around the latter.

The author therefore believes that malarial cirrhosis is primarily due to mechanical causes arising from adhesions in the transverse fissure of the liver and a general thickening of the fibrous capsule of the organ.

D. T.

De Villa (S.). **Tremore essenziale da Malaria.** [Tremor due to Malarial Infection.]—*Gaz. Internaz. di Med., Chir., Igiene.* 1913. May 10. No. 19. pp. 443-444.

The author discusses numerous disturbances of the nervous system due to malaria. He describes in detail the case of an infant of 15 months who had previously suffered from that disease. The patient was cured by quinine, but 5 days after the last attack of hyperpyrexia developed a general tremor. This consisted of very rapid rythmic and uniform oscillations which continued during sleep. No malarial parasites were found in the blood at this stage.

D. T.

Cantieri (Collatino). **Sul particolare Decorso Termico della Pneumonite Crupale in molti Soggetti Malarici (Pneumonite Remittente-intermittente dei Malarici).** [On the Pyrexial Course of Croupous Pneumonia in Malarial Subjects. Remitting Intermittent Pneumonia of Malarial Subjects.]—*La Clinica Medica Italiana.* 1913. Jan. Vol. 52. No. 1. pp. 30-51.

Croupous pneumonia when occurring in a malarial patient follows a special pyrexial course with intermittances and remittances varying in the different cases. At the onset the disease frequently simulates malarial fever; quinine however has no effect.

D. T.

LABORATORY AND EXPERIMENTAL.

i. ZIEMANN (Hans). **On the Culture of Malarial Parasites and** *Piroplasma canis.—Trans. Soc. Trop. Med. & Hyg.* 1913. May. Vol. 6. No. 6. pp. 220-227.

ii. **Uber die Kultur der Malariaparasiten und der Piroplasmen** (*Piroplasma canis*) **in vitro.**—*Arch. f. Schiffs- u. Trop.-Hyg.* 1913. June. Vol. 17. No. 11. pp. 361-391. With 2 coloured plates [issued in No. 13] and 2 curves.

i. In the cultivation of malarial parasites the author used 5 c.c. of the patient's blood to which was added 1/10 c.c. of a 50 per cent. solution of dextrose. The blood was defibrinated and the leucocytes removed by centrifuging, the top layer of serum and the bottom layer of corpuscles being transferred to another tube. He obtained the best results by using inactivated dextrose-ascitic serum. The serum was inactivated by heating to 43° C. for one hour. The malarial parasites showed in culture exactly the same morphological and biological development as in the human organism. In the culture tube the development of the benign tertian parasites took place in about 34 hours at a temperature of 39·5° C. while *Plasmodium falciparum* underwent its full development in 40-48 hours at a temperature of 37° C.; but occasional differences in the time required for their full development occurred.

In the culture tubes he found, in addition to normal parasites, forms which contained vacuoles and in which the chromatin was broken up and scattered. Such forms were never seen in the peripheral blood, though they reminded one of the degenerated quinine forms sometimes seen. In the cultures he noticed that the leucocytes ingested the degenerating and dying forms of the parasites. He was unable to observe any signs of conjugation of young schizonts as described by MANNABERG and later by CRAIG and he found no evidence of the occurrence of parthenogenesis or the formation of ookinets. The young merozoites apparently remained extra-corpuscular in the blood plasma only for a very short time after sporulation occurred. He was unable to notice that the parasites wandered from infected red cells to non-infected ones, as maintained by Mary Rowley LAWSON. He does not share the belief of BASS that it is possible to cultivate malarial parasites ad infinitum, without sexual phases intervening.

The author has also attempted the cultivation of *Piroplasma canis* by BASS's method, and succeeded after several experiments. He found that the best growth of this parasite was obtained when the blood of dogs containing few parasites was used. The growth was less successful when the blood of heavily infected dogs was employed. If the spleen is removed three or four days before taking the blood, the cultivation is invariably successful. His technique was as follows:—To 5 c.c. of defibrinated dogs' blood add 1/10 c.c. of 50 per cent. glucose solution and 0·15 c.c. of a 2 per cent. solution of sodium citrate. It is better to inactivate the serum and the leucocytes should be removed. The best

growth took place at a temperature of 37° C., but the parasites were able to grow at room temperature and also at 40° C. Sporulating forms of this parasite with more than 4 merozoites are very rarely seen in the peripheral blood of the dog, but in the culture tubes forms with 16 and more merozoites were frequently seen. The cultures remained virulent for 5 and even 6 days. He was able to obtain subcultures from a culture four days' old. After some days the parasites show signs of degeneration in the culture tubes. They lose their typical pear shape, and become rounded. The protoplasm takes on a darker stain while the colour of the chromatin becomes more faint.

ii. This article is almost identical with that summarised above except that in addition a short history is given of the previous attempts made to cultivate malarial parasites in vitro up to the time when this was first successfully accomplished by Bass in 1912. The number of spores obtained by the author in his cultures of *Plasmodium falciparum* was 14 to 18, most frequently 16. He gives a full bibliography of the cultivation of malarial parasites and of *Piroplasma canis*.

D. T.

Thomson (John Gordon). **A Demonstration on the Cultivation of the Malarial Parasites (*Plasmodium falciparum* and *Plasmodium vivax*).**—*Trans. Soc. Trop. Med. & Hyg.* 1913. May. Vol. 6. No. 6. pp. 216-219. With 1 plate.

The author gives the following conclusions regarding the cultivation of these parasites:—

1. "*Plasmodium falciparum* and *Plasmodium vivax* are capable of being cultivated up to the stage of sporulation, for at least one generation, and we have obtained evidence that *Plasmodium falciparum* may develop for several generations (at least three) in the original culture tube, without transplanting to a new medium.

2. "In some cultures the growth was rapid, in others much slower; this is explained by different factors:—(a) The age of the parasite when introduced into the culture tubes. (b) The temperature of the incubator. (c) The amount of glucose used. (d) The influence of previous administration of quinine to the patient.

"With respect to (d), we have noted that on several occasions sporulation in the case of malignant tertian fever was not completed when the patient had been treated with quinine, the maximum number of spores in cultivations prepared from these being about ten. In several cases the parasites refused to develop, and we attributed this to the fact that quinine had been administered before the blood was drawn for cultivation.

3. "The cultures of benign tertian differed from those of malignant tertian in that there was no tendency to clumping of parasites in the former, either before or during sporulation.

4. "This difference appears to us to explain in a satisfactory manner why only young forms of malignant tertian are found in the peripheral blood, as the clumping tendency of the larger forms causes them to be arrested in the finer capillaries of the internal organs. It also explains the tendency to pernicious symptoms, such as coma, in malignant tertian malaria. All stages of the benign tertian parasites are found in the peripheral blood, and there are seldom pernicious symptoms, because there is no tendency to clumping.

5. "The malignant tertian parasite (*P. falciparum*) is capable of producing, in maximum segmentation, 32 spores. On the other hand, benign tertian (*P. vivax*) produces, as a rule, during maximum segmentation, 16 spores; sometimes more may be produced, but the number is never 32.

6. "The pigment of *P. falciparum* collects into a definite, circular, and very compact mass early in the growth of the parasite. On the other hand, during the growth of *P. vivax*, the pigment remains scattered in definite granules throughout the body of the parasite, till just before segmentation, when it collects into a loose mass of granules in the centre of the full-grown *Plasmodium*."

D. T.

GURKO (A. G.) & HAMBURGER (J.). **Zur Frage über die Kultur des Plasmodiums der tropischen Malaria nach Bass und Johns.—Vorläufige Mitteilung.** [On the Culture of the Plasmodium of Malaria Tropica according to Bass and Johns.—Preliminary Note.]—*Zeitschr. f. Hyg. u. Infektionskr.* 1913. May 20. Vol. 74. No. 2. pp. 248-252.

The authors give a resumé of the attempts made by various workers to preserve or cultivate the malarial parasite, and a full account of BASS's method.

Of the authors' three experiments the first resulted in the successful growth of three generations, whilst the other two proved negative. The first was made with the blood of a boy who had never received quinine or any other treatment, and containing rings and crescents of 'malaria tropica.' The second experiment was made with blood from the same patient after 8 days' quinization and containing crescents but no ring forms. The blood for the third experiment contained crescents as well as a few rings and was taken from a boy who had had quinine.

The authors state that their observations are too few to allow of any conclusions as to the cause of the negative results in the last two experiments. Further observations are stated to be in progress.

D. T.

BILLET (A.). **Action de la Quinine sur les Hématozoaires du Paludisme.**—*Bull. Soc. Path. Exot.* 1913. May. Vol. 6. No. 5. pp. 336-339.

Billet agrees with RIEUX (this *Bulletin*, Vol. 2, p. 8) regarding the action of quinine salts on the various stages of the malarial parasite in the human blood. The author used in his experiments the formate of quinine, known under the name of quinoform. He made observations on five cases of benign tertian, one case of malignant tertian, and one case of quartan malaria. The dose of quinoform, given by mouth in a cachet, was 0·5 grammes and in two cases only 0·3 grammes. The blood was then examined hourly.

These isolated doses produced the following results:—

(1) Disintegration of the protoplasm of the benign tertian schizonts occurred sometimes as early as one hour after the administration of the drug. It was very marked after 5 hours, and the fragmentation was complete in 10 to 12 hours. The sexual parasites or gametes resisted the action of the quinine for 24 to 48 hours or longer. It is even probable that the gametes

can develop to maturity, completely resisting the action of the drug.

(2) The different phases in the degeneration of the parasites due to quinine are as follows:—(*a*) retraction of the protoplasmic processes; (*b*) disappearance of the nutritive vesicle; (*c*) progressive fragmentation of the protoplasm; the various portions contain pigment granules and are scattered more or less over the entire area of the corpuscle; (*d*) isolation and prolonged persistence of the nuclear chromatin which seems to be the most resistant part of the parasite; (*e*) finally the protoplasmic debris with the pigment is shed into the blood plasma and becomes ingested by the large mononuclear leucocytes. The enlarged, decolorised and deformed red cells can be seen, emptied of their parasites but still showing Schüffner's granules and sometimes masses of pigment.

(3) The action of quinine is more powerful upon the young parasites than upon those which are more fully developed; hence the best time to give the drug, in order to get the maximum destructive affect, is immediately after the liberation of spores, or just about the end of the febrile attack.

(4) The effect of quinine was equally rapid in the case of malignant tertian.

(5) The quartan parasites appeared to be more resistant than the benign tertian, but they eventually underwent the same phases of degeneration.

D. T.

Prophylaxis.

Ross (Ronald). **Malaria Prevention in Greece.** [Correspondence.] —*Brit. Med. Jl.* 1913. May 31. p. 1186.

The author visited Greece seven years ago. At that time the British employees of the Lake Copais Co., suffered much from malaria. He advised that the neighbouring collections of water should be kept free from weeds and periodically oiled and that the houses should be rendered mosquito proof. In 1913 he again visited the locality and found that there had been no case of malaria among these employees for some years past, his recommendations having been carried out thoroughly. In the neighbouring Greek village of Moulki much quinine has been distributed by the Grecian Government, especially to the children. In 1906 the author found splenomegaly in 56 per cent. of the children. This year he found it only in 28 per cent. of the children examined. He considers however that the spleen rate has been reduced 50 per cent., since in the later examination he included spleens showing very slight enlargement. Moreover the children and the villagers in general looked in every way much healthier than they did on his former visit. The pools around the village still remain, although they are oiled periodically. He believes that it would be cheapest and best in the end to abolish these pools. Shortly after his first visit, the Liverpool School of Tropical Medicine raised a subscription of several hundreds of

pounds for the Greek Antimalarial League. This league persuaded the Greek Government to make quinine a state monopoly in order to avoid expense and adulteration. The League is doing excellent work, but the Greek Government only gives it 5,000 drachmae (francs) a year. On the other hand the Government is making profit out of the sale of quinine, amounting to 83,000 drachmae in 1911. The author urges that this money should be used for malaria prevention.

D. T.

MEREU (Francesco). **La Malaria in Nurra. Condizioni Sociali. Economiche ed Igieniche.** [Malaria in Nurra, Sardinia. Social, Economic, and Hygienic Conditions.]—*Malaria e Malat. d. Paesi Caldi.* 1913. Apr.-May. Vol. 4. No. 3. pp. 182-188.

Malaria plays an important role in the death-rate of Nurra. The malarial season, from July to November, is at its height in September. Aestivo-autumnal fever is more frequent than tertian; quartan is entirely absent.

D. T.

i. BRIGNONE (Emiliano). **La Propaganda e Profilassi Antimalarica nelle Scuole comunali di Terranova Monferrato durante l'Anno 1912. Relazione a S.E. il Ministro dell' Istruzione.** [Antimalarial Propaganda and Prophylaxis in the Elementary Schools of Terranova Monferrato in 1912. Report to the Minister of Education.]—*La Propaganda Antimalarica.* 1913. June. Vol. 6. No. 3. pp. 57-68.

ii. MALTESE (Paolo). **Educazione Antimalarica e Profilassi Antimalarica Scolastica nella Provincia di Trapani. Relazione a S.E. il Ministro della Pubblica Istruzione.**—*Ibid.* Apr. No. 2. pp. 36-45.

iii. SERGI (Antonio). **La Profilassi scolastica antimalarica nel 1912 in Palizzi Marina.**—*Ibid.* June. No. 3. p. 69.

i. Climatic conditions were most favourable to the development of mosquitoes during this year; *A. maculipennis* and *A. bifurcatus* were very numerous. Realizing the danger of a severe recrudescence of malarial fever, the author organised a system of rigid vigilance and prophylaxis.

Public instruction was given; more especially instruction to the children at the schools. The author explains at length the advantages of scholastic instruction over all other forms of anti-malarial propaganda. State quinine was given to the school children on alternate week days from March to June. All these measures were scrupulously carried out and the results according to the author were brilliant.

ii. This Report is drawn up on the same lines as that by Brignone; also here the results obtained were excellent. A series of lectures on the malarial problem had been given to the school teachers.

iii. The same excellent results were obtained. Among 68 school children who received their quotidian dose of state quinine, only one slight case of benign tertian developed after the first days of the quinization, in a child who had had malaria previously. No further cases developed during the two months of this treatment. During the same period 57 cases of malaria were reported amongst the population of 2,000 (*i.e.*, 171 per thousand per annum).

D. T.

SKELTON (D. S.). **Report on the Measures Necessary to reduce Malarial Fever in Zanzibar.** — Report dated Health Office, Zanzibar, Feb. 15, 1913. Received in Colonial Office Apr. 30, 1913.

The author states that malaria is responsible for about 175 deaths a year in Zanzibar town. Since the mortality rate in malaria is very low, this number indicates that the disease must be very prevalent. The measures which he considers necessary to reduce the malaria rate are excellent; among others he suggests that a mosquito brigade should be formed consisting of four mosquito inspectors, twelve workers, and one inspector for swamps. The estimated cost of this would be about £400 a year. It is hoped that the Colonial Office will approve and adopt his suggestions.

D. T.

MONKEY MALARIA.

BOUILLIEZ (M.). **Nouvelles Recherches expérimentales sur un Plasmodium des Singes.** — *Compt. Rend. Soc. Biol.* 1913. May 23. Vol. 74. No. 18. pp. 1070-1072.

The author has inoculated successfully several species of monkeys with *Plasmodium inui.* In most of these the infection was chronic, but one monkey (*Cercopithecus callitrichus*) had a very acute attack to which it succumbed, twelve days after inoculation. This monkey moreover developed haemoglobinuria just before it died. In two cases splenectomy was performed. In the first case it appeared to cause a more prolonged exacerbation of the disease than usual. In the second case it resulted in a very acute attack with increase in the number of parasites and death in six days. He was unable to find any morphological change in the parasites such as was described by BOUNIOL as the result of splenectomy (see this *Bulletin*, Vol. 2, p. 157). Two monkeys, of 900 and 1,300 grammes respectively, were inoculated with the parasites and at the same time with 7 centigrammes and 12·5 centigrammes of quinine. The quinine was injected into one thigh, the inoculation into the other. Neither contracted the disease. The author concludes that it had a prophylactic effect. He was unable however to find that quinine even in very large doses had any curative effect in monkeys. Two animals died of the disease in spite of the quinine treatment. An attempt was

made to cultivate the parasites according to BASS's method. No success was obtained by incubating at a temperature of 40° C., but at a temperature of 22° C. there was apparently an increase in the number of parasites after six days, and numerous rosette forms appeared.

D. T.

BLACKWATER FEVER.

SOREL. **Traitement de la Fièvre Bilieuse Hémoglobinurique par les Injections et Lavages de Solutions Sucrées.** [Clinique d'Outre-Mer.]—*Ann. d'Hyg. et Méd. Coloniales.* 1913. Jan.-Feb.-Mar. Vol. 16. No. 1. pp. 194-199.

During the last two years the author has treated six cases of blackwater fever at Bassam (West Africa). All recovered. He maintains that this disease, whatever the cause, is essentially a toxic condition. It is therefore good practice to keep the kidneys acting by means of hot drinks and saline injections; but this is insufficient, for in many cases the patient succumbs to an intoxication of the nervous system, even though the action of the kidneys is well maintained. This nerve intoxication is indicated by the feeble irregular pulse, by the state of semi-delirium and finally death from syncope. FLEIG, ARROUS and JEANBRAU have demonstrated that intravenous injections of glucose, lactose, or mannite solutions have a powerful tonic action on the heart and a specific action on the nerve centres in that they cause a rapid elimination of toxins such as occur after anaesthesia in surgical operations; moreover they have injected intravenously as much as 1,300 c.c. of these solutions without producing any bad effects on the kidneys. The author on these grounds has employed sugar solutions in the treatment of blackwater fever in six cases.

Case I. The patient suffered from nephritis and during his blackwater attack passed very little urine in spite of hot drinks and saline injections. Later he developed complete suppression. The author then injected 300 c.c. of an isotonic lactose solution, and 12 hours later 250 c.c. The patient passed urine freely in two hours after the first injection. After 12 hours Sorel administered another injection of 350 c.c. lactose and also washed out the bowel with a litre of the same solution. The patient improved rapidly and recovered in a very satisfactory manner.

Details are given of the remaining five cases which were treated successfully in a similar manner. Glucose solutions appeared to be as beneficial as the lactose solutions. These solutions were made in the following strengths: crystallised lactose 92·5 grammes, water 1,000 c.c.; crystallised glucose 47 grammes, water 1,000 c.c. The author suggests that on three consecutive days a subcutaneous injection of 250 c.c. should be given in the morning, followed by an injection per rectum of 700 to 800 c.c. in the evening. In a very grave case he obtained most beneficial results after an intravenous injection of 250 c.c. of the glucose solution.

D. Thomson.

LOVELACE (Carl). **The Etiology and Treatment of Hemoglobinuric Fever. A Report of Five Hundred and Fourteen Cases.**—*Arch. Internal Med.* 1913. June 15. Vol. 11. No. 6. pp. 674-684.

This paper is based on 514 cases of blackwater fever treated by American physicians in the hospital of the Madeira-Mamore Railway Company, Porto Velho, Brazil, between January 1, 1908, and November 27, 1912. [If all these cases were really blackwater fever it indicates a very high degree of infection in those parts.] The study brings out, what has so often been brought out before, that malarial infection stands in a direct causal relationship to blackwater fever, that blackwater fever is not due to any particular species of malarial parasite, that quinine in large or small doses may be an antecedent of the haemoglobinuria, that this drug should not be given during the attack, that normal saline solution should be given to keep up the blood pressure, and that the prophylaxis of malaria is the prophylaxis of blackwater fever.

G. C. LOW.

LOW (George C.) & WENYON (C. M.). **Cell Inclusions in the Leucocytes of Blackwater Fever and other Tropical Diseases.**—*Jl. Trop. Med. & Hyg.* 1913. June 2. Vol. 16. No. 11. pp. 161-163. With 1 coloured plate and 2 text-figs.

The authors have searched for cell inclusions in the blood in various tropical diseases, viz.: malaria (recent and chronic), blackwater fever, trypanosomiasis, sprue, filiariasis, and anaemias of various kinds. Inclusions occurred chiefly in the cells of the large endothelial type. They believe that the largest inclusions are derived from ingested normoblastic nuclei. The medium sized inclusions would seem in many cases to originate in the nuclei of the cells themselves, but in other instances might result from the ingestion of parasites containing chromatin (trypanosomes, leishmania, malaria, etc.). They might also be the products of disintegration of ingested nuclei, such as the nuclei of lymphocytes or normoblasts (nucleated red cells). In the coloured plate accompanying their article there are depicted various types of cell inclusions; among these is a remarkable display of inclusions in the large endothelial cells from the peritoneal exudate of a mouse inoculated with *Leishmania tropica*. These represent the nuclei of various ingested cells in different stages of disintegration. In a severe fatal case of blackwater fever they failed to find large endothelial cells or inclusions. So far as they can judge from the varying origin and occurrence of these inclusions it does not seem legitimate at present to associate them with any particular disease, and in their opinion there seems to be no possibility of their being parasitic in nature. They believe that the bodies described recently by COLES in a case of blackwater fever blood resemble artefacts more closely than anything else, and they certainly do not look upon them as parasites. Apart from the cell inclusions in the leucocytes therefore, and these would not appear to be parasitic in origin,

no other appearances resembling protozoal parasites, so far as they know, have been seen in the blood of blackwater fever by the many investigators who have studied the disease.

D. T.

Boogher (Leland). **Malarial Hematuria.**—*New York Med. Jl.* 1913. June 21. Vol. 47. No. 25. pp. 1291-1293.

Three cases of "malarial haematuria" are described. In all of these the urine contained large numbers of red blood corpuscles in which, the author states, he saw malarial plasmodia. One of the cases had lived in a malarial district all his life but had enjoyed good health up to the year previous to his attack. The other two patients were said to have suffered from malaria previously. [The author does not bring forward any definite proof in the history of his cases that these haematurias were really due to malaria—they were evidently not cases of blackwater fever with which disease he has confused haematuria.]

G. C. L.

SLEEPING SICKNESS.

Trypanosomiasis in Nyasaland and Rhodesia.

Bruce (David), Harvey (David), Hamerton (A. E.), & Lady Bruce. **Morphology of Various Strains of the Trypanosome causing Disease in Man in Nyasaland.—The Wild-game Strain.** —*Proc. Roy. Soc.* 1913. June 12. Series B. Vol. 86. No. B 589. pp. 394-407. With 7 charts.

The wild-game strains were isolated by injecting blood of antelope into susceptible animals—goat, monkey and dog—and from these other animals were inoculated. Trypanosomes from the following species were studied—reedbuck, waterbuck, oribi and hartebeeste (2).

The results obtained by measuring 500 individuals of each of the five strains in rats are set forth in tables and charts.

Unlike the curves of the Human strains those obtained from the wild-game strains are all remarkably alike, and there can be little doubt that the same species of trypanosome is being dealt with in all five strains. The wild-game curves resemble those of the Human strains II, IV, and V described in a former paper (see this *Bulletin*, Vol. 1, p. 659) and also those found by Kinghorn and Yorke in the Luangwa Valley (*Sleeping Sickness Bulletin*, Vol. 4, p. 170).

The percentage of posterior nuclear forms found among the short and stumpy varieties of the trypanosomes of the five wild-game strains was 8·4, 30·7, 30·3, 28·3 and 33·4 respectively.

The following are the conclusions:—

1. The five Wild-game strains resemble each other closely, and all belong to the same species of trypanosome.
2. The Wild-game strains and the Human strains, although they differ to some extent, also belong to the same species.
3. This species is *T. rhodesiense* (Stephens and Fantham).
4. There is some reason for the belief that *T. rhodesiense* and *T. brucei* (Plimmer and Bradford) are one and the same species.

W. Yorke.

Bruce (David), Harvey (David), Hamerton (A. E.), & Lady Bruce. **Morphology of Various Strains of the Trypanosome causing Disease in Man in Nyasaland. — The Wild *Glossina morsitans* Strain.**—*Proc. Roy. Soc.* 1913. June 12. Series B. Vol. 86. No. B 589. pp. 408-421. With 7 charts.

The strains were obtained by bringing wild tsetse flies (*Glossina morsitans*) to the laboratory from the neighbouring "fly country" and at once allowing them to feed on healthy animals. The first strain was obtained by feeding the flies on a monkey, the remaining four by feeding on dogs. As soon as the healthy animal was found to be infected other animals were

inoculated from it. As in the case of the wild-game strains, only trypanosomes from a single rat were used for purposes of measurement and comparison.

The results obtained by measuring 500 individuals of each of the five strains are given in tables and charts.

The curves of the wild-game strains and the wild *Glossina morsitans* strains are so similar that there can be little doubt that the same species of trypanosome is being dealt with. The Human strain differs so much, that "the suspicion must present itself that in some way more than one species is being dealt with." The three Human strains which differ most from the wild-game and wild *Glossina morsitans* type are STEPHENS and FANTHAM's case of Armstrong, and strains I and III (see this *Bulletin*, Vol. 1, p. 659). On examining these three strains, however, from every possible point of view, nothing except the difference in the type of the curve can be found to justify this suspicion.

The following are the conclusions:—

1. The five Wild *Glossina morsitans* strains resemble each other closely, and all belong to the same species of trypanosome.
2. The Wild *Glossina morsitans* strain, the Human strain, and the Wild-game strain, belong to the same species.
3. This species is *T. rhodesiense* (Stephens and Fantham).
4. It is probable that *T. rhodesiense* and *T. brucei* (Plimmer and Bradford) are identical.

[The work of STEPHENS and BLACKLOCK (see this *Bulletin*, Vol. 1, p. 662) showed that *T. brucei* (PLIMMER and BRADFORD) is a monomorphic trypanosome and easily distinguishable from the polymorphic *T. rhodesiense*. LAVERAN in a more recent paper (see this *Bulletin*, Vol. 2, p. 137) supports the conclusions of STEPHENS and BLACKLOCK.]

W. Y.

BRUCE (David), HARVEY (David), HAMERTON (A. E.), & Lady BRUCE. **Infectivity of *Glossina morsitans* in Nyasaland.**—*Proc. Roy. Soc.* 1913. June 12. Series B. Vol. 86. No. B 589. pp. 422-426.

This paper records the results of feeding 10,081 wild *Glossina morsitans*, caught in the "Proclaimed Area" of Nyasaland, on monkeys, dogs and goats. Each cage of flies was fed on three healthy animals—the first day on a monkey, the second on a dog, and the third on a goat. To ensure, as far as possible, that each animal was fed on by every fly, the flies were fed nine times—three times on each animal.

The results obtained by feeding these flies, in 56 batches, are given in a table, and show that four species of trypanosomes, viz., *T. brucei* vel *rhodesiense*, *T. pecorum*, *T. simiae* and *T. caprae*, are carried by *Glossina morsitans* in this district.

Ten thousand flies gave rise to 135 infections and, assuming that no fly was infective with more than one species of trypanosome, 13·5 per 1,000 flies are infective with one or other of the disease-producing trypanosomes of this district.

Table III.—The Proportion per 1,000 Tsetse Flies, caught in the "Sleeping Sickness" Area of Nyasaland, found to be infective with Pathogenic Trypanosomes.

T. Brucei vel *rhodesiense.*	*T. pecorum.*	*T. simiae.*	*T. caprae.*
Per 1,000. 2	Per 1,000. 4·6	Per 1,000. 3·4	Per 1,000. 3·5

Infective flies occur all the year round and are just as numerous during one season as another. No experiments were carried out during July and August.

The following are the conclusions:—

1. The tsetse flies (*Glossina morsitans*) caught in the "fly-country" near Kasu are infected with four species of disease-producing trypanosomes—*T. brucei* vel *rhodesiense, T. pecorum, T. simiae,* and *T. caprae.*
2. The proportion of infective flies is 13·5 per 1,000.
3. The proportion of flies infective with *T. brucei* vel *rhodesiense,* the cause of the Human Trypanosome Disease of Nyasaland, is 2 per 1,000.
4. The flies are found infective all the year round.
5. To prevent the infection of tsetse flies it is proposed that the experiment should be tried of destroying all the wild game in the "Proclaimed Area" of Nyasaland.

[These results confirm and extend those of Kinghorn and Yorke in the Luangwa Valley of Northern Rhodesia (*Sleeping Sickness Bulletin,* Vol. 4, p. 321).]

W. Y.

Kinghorn (Allan), Yorke (Warrington), & Lloyd (Llewellyn). **Final Report of the Luangwa Sleeping Sickness Commission of the British South Africa Company 1911-1912.**—*Ann. Trop. Med. & Parasit.* 1913. June 10. Vol. 7. No. 2. pp. 183-302. With 12 plates.

Most of the contents of this Report have been already published and have been noticed in this and in the *Sleeping Sickness Bulletin.** The matter is here somewhat differently arranged.

Section I by Kinghorn and Yorke deals with the human trypanosome. There are considered the distribution of the disease; the clinical features; the identity of the trypanosome with *T. rhodesiense*; the transmission of the trypanosome in the valley and on the plateau respectively; the influence of meteorological conditions on the development of the trypanosome in *Glossina morsitans*; the reservoir of the trypanosome; the occurrence of the trypanosome in *Glossina morsitans* in nature; the identity of the game and fly strains with the human strain of *T. rhodesiense.* The summary is as follows:—

"1. The human trypanosome (*T. rhodesiense*) is distributed widely throughout South Central Africa.

"2. There is no essential difference between the clinical manifestations of the disease in man caused by *T. rhodesiense* and that due to *T. gambiense,* except possibly the greater virulence of the former.

* See *Sleeping Sickness Bulletin* Vol. 4, pp. 165, 170, 235, 315, 321, and *Tropical Diseases Bulletin* Vol. 1, pp. 43, 126, 268, 276, 516.

"3. *T. rhodesiense* is transmitted in Rhodesia by *Glossina morsitans.*

"4. Approximately 3·5 per cent. of the flies may become permanently infected and capable of transmitting the virus.

"5. The period which elapses between the infecting feed of the flies and the date on which they become infective varies from eleven to twenty-five days in the Luangwa Valley.

"6. Attempts carried out at laboratory temperature on the Congo-Zambesi plateau during the cold season to transmit the human trypanosome by means of *Glossina morsitans* were invariably unsuccessful in spite of the fact that 680 flies were used in these experiments.

"7. The developmental cycle of *T. rhodesiense* in *Glossina morsitans* is to a marked degree influenced by the temperature to which the flies are subjected. High temperatures (75-85° F.) favour the development of the parasite, whilst low temperatures (60°-70° F.) are unfavourable.

"8. The first portion of the developmental cycle can proceed at the lower temperatures, but for its completion the higher temperatures are essential.

"9. The parasites may persist in the fly at an incomplete stage of their development for at least sixty days under unfavourable climatic conditions.

"10. These observations afford an adequate explanation of the extremely long latent periods of trypanosomes in *Glossina* which have occasionally been observed by various workers.

"11. The relative humidity of the atmosphere has apparently no influence on the development of the trypanosome in *Glossina morsitans.*

"12. Mechanical transmission does not occur if a period of twenty-four hours has elapsed since the infecting meal.

"13. *Glossina morsitans,* in nature, has been found to transmit the human trypanosome.

"14. The chief reservoir of the human trypanosome is the antelope.

"15. The results of examination for the human trypanosome of the blood of a large number of monkeys, wild rats and mice were invariably negative."

Section II, by the same authors, deals with the trypanosomes of game and domestic stock. The conclusions reached are as follows:—

"Trypanosomes are of frequent occurrence in game and domestic stock in North Eastern Rhodesia. As a conservative estimate the percentage of big game infected with trypanosomes pathogenic to man and domestic stock may at Nawalia (Luangwa Valley) be placed at 50, and at Ngoa (Congo-Zambesi watershed) at 35.

"At Nawalia six species of trypanosomes were isolated from game and domestic stock, viz., *T. rhodesiense, T. vivax, T. nanum, T. pecorum, T. montgomeryi,* and *T. multiforme;* whilst at Ngoa five species were found, viz., *T. rhodesiense, T. vivax, T. nanum, T. pecorum,* and *T. tragelaphi.*

"The results of examination of over 400 monkeys, wild rats and mice were invariably negative."

Section III deals with the trypanosomes found in wild *Glossina morsitans.* The summary is as follows:—

"*T. rhodesiense, T. ignotum* and *T. pecorum* are transmitted by *Glossina morsitans* in nature, and were obtained by feeding wild freshly-caught *Glossina morsitans* on healthy monkeys."

Section IV deals with the description of the trypanosomes found. All are figured in coloured plates. *T. multiforme* was isolated from a bushbuck at Nawalia (valley). It is stated that this parasite is at once distinguished from *T. pecaudi* and *T. rhodesiense* by the absence of posterior nuclear forms and by its slight pathogenicity for laboratory animals. It closely resembles *T. gambiense,* from which it is not easily distinguished. A study of the biometric curve shows certain differences, and a comparison of the percentages of short, intermediate, and long forms shows that this parasite has very few intermediate forms (the percentage

is 12·5 against 23·1 for *T. gambiense*). The authors conclude that the parasite is a new species. The biometric curve is given, a table of measurements, and a table of pathogenicity.*

Writing of *T. ignotum*, which, the authors say, is almost certainly identical with *T. simiae* of BRUCE, they note that three monkeys inoculated on the plateau with the valley strain of the parasite failed to become infected.

T. tragelaphi was found in blood films made from a sitatunga shot near Mpika; it bears a very close resemblance to *T. ingens*. Five specimens were seen. Being shorter and more slender than *T. ingens* it is described as a new species. The sitatunga lived in a large swamp at least fifteen miles from a *Glossina morsitans* area. It is suggested that leeches, which were found in enormous numbers, are the vectors of the parasite, more particularly as it is very like an amphibian trypanosome.

Section V dealing with the development of *T. rhodesiense* in *Glossina morsitans* is by KINGHORN, YORKE and LLOYD. The summary is as follows:—

"1. The salivary glands of all *Glossina morsitans* capable of transmitting *T. rhodesiense* are infected, and conversely without invasion of the salivary glands there is no infectivity of the fly.

"2. Invasion of the salivary glands is secondary to that of the intestine.

"3. The first portion of the developmental cycle of the trypanosome takes place in the gut. In order for its completion and for invasion of the salivary glands to occur, a relatively high mean temperature, 75°–85° F., is necessary.

"4. Invasion of the salivary glands was only found in flies infected with the human trypanosome, *T. rhodesiense*.

"5. The predominant type of the trypanosome in the intestine of infected *Glossina morsitans*—a large broad form—is quite different from that which predominates in the salivary glands, where the parasite resembles somewhat the short form seen in the blood of the vertebrate host.

"6. Both the intestinal forms and also those from the salivary glands of infective *Glossina morsitans* are virulent when inoculated into healthy animals."

A coloured plate shows five typical forms seen in the salivary glands and nine intestinal forms.

Section VI is the report of the Entomologist, Ll. LLOYD. Much of this has not previously been published. It is noted that in collections of *G. morsitans* the percentage of females was often as low as 2. Of the flies bred in the laboratory the pupation period varied from 21 days in a pupa exposed to a temperature slightly over 86° F. to 88 days for a pupa exposed to 62° F., but such extremely high and low temperatures had a deleterious effect on the pupae; in a large percentage the flies did not emerge. Details are given of places where pupae were discovered in nature, with many photographs. They were found in association with trees of eight different species and in holes in the earth; all the trees were either abnormal or injured. They were generally, though not always, hidden by a slight covering of earth or dead leaves. Of the 54 living pupae found 49, or 90 per cent., were so placed that they would be daily warmed by the sun. They were collected in the coldest part of the year. A table shows that for temperatures below 70° F. an increase of one degree in

* Dr. Andrew BALFOUR suggests that his mule trypanosome from Western Mongalla (see this *Bulletin* Vol. 1, p. 673) is *T. multiforme*.

the mean temperature caused a reduction of the pupation period of from three to five days. A list is given of the blood-sucking insects and ticks collected in the valley and on the plateau.

Two Appendices deal with an experiment to ascertain whether Tabanids transmit trypanosomes in nature, by WALLACE and LLOYD, and an attempt to transmit *T. rhodesiense* by means of *Ornithodorus moubata,* by A. F. WALLACE. The Tabanidae as they were caught were placed on a monkey; only a small proportion fed. The monkey did not become infected. All the flies that fed, *viz.*, 128, were dissected and examined the same day. Flagellates confined to the mid and hind gut were found in seven.

For the tick transmission experiments the ticks had to be brought from the plateau, there being none in the valley; the natives say that it is too hot for them. Each group of ticks was fed on a *T. rhodesiense* monkey, and after an interval of about a month on a clean monkey. The following is a summary:—

125 ticks were fed on a heavily infected monkey.

After	1	month	87	were fed	on a	clean	monkey.
,,	2	,,	51	,,	,,	,,	,,
,,	3	,,	8	,,	,,	,,	,,
,,	6	,,	23	,,	,,	,,	,,
,,	7	,,	10	,,	,,	,,	,,

The blood of the animals remained negative. 61 ticks were used in interrupted feeding experiments with uniformly negative results.

A. G. B.

YORKE (Warrington). i. **Sleeping Sickness and Big Game: A Proposed Experiment.**—*Brit. Med. Jl.* 1913. June 21. pp. 1315-1317.

ii. **The Relationship of the Big Game of Africa to the Spread of Sleeping Sickness.** — *Proc. Zoolog. Soc. of London.* 1913. June. pp. 321-337.

i. The author gives the gist of the findings of himself and KINGHORN in North Eastern Rhodesia. They proved that *G. morsitans* spreads the human trypanosomiasis of that country and found 1 in 500 of the flies caught in the Luangwa valley to be infective. They then examined a large number of wild animals, 698 in all, with a view to discovering the reservoir of the infection and found the trypanosomes of man or of stock in a considerable percentage of the antelope examined, 50 per cent. in the valley and 35 per cent. on the watershed. The corresponding figures for man were 16 and 3·3. Details are given in tables. The possible methods of dealing with the disease are then considered. It is concluded that the fly cannot be exterminated, nor the population removed from contact with it, and that the only possible course is to destroy the reservoir. Some of the objections that have been raised are considered. The author

favours an experiment of game destruction and says how in his opinion it should be carried out—

"A locality which is fairly well populated, and which contains plenty of tsetse fly and game should be chosen. An exact census of the population should be made, and the proportion suffering from trypanosomiasis determined. The same must be done in the case of the domestic animals, if such exist. An index of the percentage of infective tsetse fly must be ascertained. This is most important, as it gives a definite idea of the potential danger of the district. Finally, the game must be completely eradicated, and at the same time the percentage infected with the human and cattle trypanosomes determined, and when once the game has been driven out it must be kept back by vigorous action and not allowed to return. After an interval of some years the population, domestic stock, and tsetse fly must again be carefully examined. Then we should be in a position to decide definitely whether or not driving the wild fauna back from the sites of human habitations in fly areas would be advantageous on a general scale in tropical Africa. As such an experiment as this would take some years to accomplish, I consider that for the present the game laws should be removed in fly areas, and that Europeans and natives should be allowed to kill what they like, especially in the inhabited portions of these areas."

He notes that it is proposed to depopulate the Sebungwe district, the focus of human trypanosomiasis south of the Zambesi. He thinks that this is wrong and that the game should be attacked with a view to stamping out the disease.

ii. The second paper traverses the same ground. An appendix contains the views of Fellows of the Zoological Society who took part in the discussion. [The opinions expressed had reference to the general question of game destruction rather than to the experiment advocated by Yorke.]

A. G. B.

Mackenzie (A.). **Report on the Mafungabusi Fly Area, Southern Rhodesia.**—MS. Report to the British South Africa Company. Dated Jan. 29, 1913.

An expedition was undertaken with the object of defining the fly area in such parts of the Hartley and Mafungabusi districts as are traversed by the main footpaths from the Zambesi to Hartley. With respect to the type of country frequented by fly the author writes that he noticed the fly was almost entirely confined to the Mopani or else it was found in the bush in close proximity to a Mopani belt.

Throughout the journey all the natives met with at the various kraals were examined and blood smears taken from each. The slides, 500 in number, were all found to be negative.

In the fly area on the Mafungabusi side of the Umniati there was very little game, whilst on the Hartley side there was no sign of game except bushbuck in the bed of the river. The blood of numerous buck was examined for trypanosomes, but with negative results.

The only domestic animals seen were sheep, goats and dogs. The natives in the fly area informed the author that animals born in the neighbourhood survived, whereas imported beasts usually died. Numerous trypanosomes were found in the blood of one sheep.

W. Y.

Sleeping Sickness Research in Uganda.

Reports of the Sleeping Sickness Commission of the Royal Society.—No. 13.—ii. + 142 pp. With 7 plates. 1913. London: H.M. Stationery Office. [Price 2*s.* 6*d.*]

This is a lengthy report containing eleven papers by Dr. H. L. Duke and three by Miss Robertson. Part of the work here recorded has already been published as separate papers in the *Proceedings of the Royal Society* and has received notice in this and the *Sleeping Sickness Bulletin.*

An account is here given of the six papers which have not been previously published.

Notes on *T. gambiense* and *G. palpalis.* By H. L. Duke. pp. 13-21.

Experiments were undertaken to ascertain whether the nature of the blood ingested by the flies during the earlier days of an experiment had any effect on the development of *T. gambiense* in the fly. In this series of experiments *G. palpalis* were fed for 1 or 2 days on an infected monkey and subsequently, after starving for a day, on various clean animals—bushbuck, fowl, monkey, sheep, and calf. The flies were dissected and the number of positive ones determined. The results are summarised in the following table:—

Expt. No.	Percentage of positive flies with goat or buck blood.	Percentage of positive flies with cock or monkey blood.
	per cent.	per cent.
357 and 358 ...	11·5	2·6
567 „ 568 ...	3·5	0
581 „ 582 ...	20·6	3·6
617 „ 618 ...	3·7	0
127 „ 128 ...	0 (calf blood)	3·3

The percentage of positive flies is considerably greater in those experiments where the flies had been fed upon sheep or bushbuck blood. In spite of the contradictory result with the calf, the evidence of the first four experiments is sufficiently definite to afford a striking contrast to the results of Kleine and Fischer (*Sleeping Sickness Bulletin*, Vol. 3, p. 402) who obtained approximately 10 per cent. of infected flies when monkeys were used throughout the experiment as against 2·4 per cent. when ruminants were employed.

The obvious criticism of these results is that the difference is due to the flies having picked up flagellates other than *T. gambiense* from the sheep or bushbuck employed. Accordingly, control observations were made to prove that the sheep and bushbuck employed in the above experiments were free from sources of error. The conditions are doubtless very different at Tanganyika and Mpumu, both as regards the strain of trypanosome and the climate. This must account largely for the discrepancies

between the two sets of experiments. Moreover, as no reference is made by the German authors to the presence or absence of flagellates in the salivary glands, it is possible that some of their "*infizierte Fliegen*" showed no salivary infection and were hence incapable of infecting. Finally, the work of Miss ROBERTSON (*Sleeping Sickness Bulletin*, Vol. 4, p. 267) has demonstrated the occurrence of periods in the subject of trypanosomiasis when, quite irrespective of the mere presence of flagellates in the peripheral blood, the trypanosomes appear incapable of full development in the fly.

Observations were undertaken to ascertain the length of time laboratory bred *G. palpalis* survived starvation after feeds on various species of animals. There did not appear to be any marked difference in the various animals used. All except one fly were dead on the 18th day after the initial feeds. The remaining fly died on the 21st day.

An experiment was undertaken to show that *G. palpalis* infective for *T. gambiense* is capable of infecting monkeys on three consecutive days.

It was found that feeding a large number of negative *G. palpalis* on a monkey does not interfere with subsequent infection of the monkey with positive flies.

The Sleeping Sickness Reservoir on the Islands of Lake Victoria, Nyanza. By H. L. DUKE. pp. 54-57.

This paper deals with the problems relating to the continued infectivity of wild *G. palpalis* on the Northern Islands of Lake Victoria after the removal of the population.

A brief account of the distribution and general character of the islands is given. The only species of antelope found on these islands appears to be the sitatunga (*Tragelaphus spekei*). In several instances, since the removal of the island population, the antelope have migrated across the intervening channels to islands where they were formerly unknown. The distribution of *G. palpalis* is practically universal throughout the islands. Only the smallest rocks, almost bare of vegetation, are free from fly. The fly are found in large numbers on those islands where sitatunga abound, *e.g.*, Damba and Bugalla of the Sese group, and Buziri near Buvuma.

An account is given of experiments to determine the infectivity of sitatunga and wild *G. palpalis* on certain of the islands. Wherever Glossina and buck occur together in numbers on an island, there the fly are found to be infective with *T. gambiense*. The degree of infectivity of the fly appears to be directly proportional to the frequency of exposure of the antelope to their bites. On islands where fly are very numerous and buck absent the former are apparently non-infective, even though hippos, reptiles and birds abound. All the facts point strongly to *Tragelaphus spekei* acting as a true reservoir for *T. gambiense* on these uninhabited islands; and the same doubtless is equally true as regards *T. vivax* and *T. uniforme*.

Further Investigations on the Rôle of Antelope as a Reservoir of *T. gambiense.* By H. L. Duke. pp. 58-66.

Reference is made to a previous paper (*Sleeping Sickness Bulletin*, Vol. 4, p. 273) wherein it was shown (1) that antelope may remain capable of infecting *G. palpalis* with *T. gambiense* for at least twenty-two months after their original infection with this trypanosome; (2) that there is some evidence to show that an antelope which has ceased to be infective for *T. gambiense* acquires some degree of immunity against re-infection. Attempts were made to reinfect five antelope originally infected in April, 1910, which had shown no signs of infection for considerable periods. The attempts at reinfection were made in April, 1912. Of the five, two exhibited complete resistance, while the other three developed transitory infections. No protective bodies were demonstrated in the sera of these animals.

A Trypanosome from British East Africa Showing Posterior-Nuclear Forms. By H. L. Duke. **(With a Note on its Developmental Stages in** *G. palpalis.* By Muriel Robertson.) pp. 67-89.

This trypanosome was isolated from a donkey infected on the Wewe river. Details of its morphology are given. Briefly it may be described as a polymorphic parasite 12-38μ long. The nucleus in a very considerable number of examples is situated posteriorly, close to the blepharoplast. The animal reactions of the parasite are given in tabular form. It proved virulent for monkeys, dogs, rats, rabbits, donkeys, goats, sheep and oxen: only one of six guineapigs became infected. The author points out that, except for its behaviour in guineapigs, the pathogenicity of the trypanosome corresponds roughly with that of *T. pecaudi.* The lack of objective symptoms in sheep and goats appears to exclude *T. rhodesiense.* Experiments were undertaken to ascertain the action of human serum curatively and protectively on the infection in rats. The curative action was found to be weak and uncertain, but the protective action was much more marked, although complete prevention of infection was not observed.

G. palpalis fed on infected animals became infective and capable of transmitting the parasite to healthy animals. The cycle of infection in the fly was studied. After establishing their base in the "hind" and "fore gut" the flagellates advance towards the opening of the salivary gland ducts via the proventriculus. The earliest invasion of the salivary glands occurred on the 25th day when flagellates were seen in the proximal part of the gland and only rare colonies of attached individuals were observed further back; no forms were, however, to be found posterior to the proximal half of the organ. These flies were apparently unable to infect a monkey. The flies first became infective on the 26th day of the experiment. With the above exception every monkey which was fed upon by a fly showing flagellates in the salivary glands became infected.

The author continues by discussing the value of the manner in which trypanosomes infect the invertebrate host as a means of diagnosis. The results obtained by many workers have proved conclusively that the different species of mammalian trypanosomes do not all take up the same position in the alimentary tract of the intermediate host. Personal experience enabled the author to speak of 6 different species, viz., *T. gambiense*, *T. nanum*, *T. vivax*, *T. pecorum*, *T. uniforme*, and the subject of this paper. Before completing its development in the fly, each species takes up what may be termed its "anterior station," which in the case of the above is either the proboscis or salivary glands. In no case have developing flagellates been found in both situations simultaneously. On rare occasions a few trypanosomes may be found in the proboscis of flies showing salivary infection, but these almost certainly came from the gut or glands.

Of the above mentioned species *T. uniforme* and *T. vivax* are exclusively proboscis forms; *T. pecorum* and *T. nanum* show "infection totale" *sensu* Roubaud, and *T. gambiense* and the subject of this paper develop in the gut and salivary glands.

Comparison of the various species of trypanosomes dealt with by other observers, with these gives the following: (1) "Infection totale" of proboscis and gut—*T. congolense*, *T. pecorum*, *T. nanum* and *T. pecaudi*; (2) Proboscis infection only—*T. vivax*, *T. uniforme* and *T. cazalboui*; (3) Infection of gut and salivary glands, none in the proboscis—*T. gambiense*, *T. rhodesiense* and *this trypanosome*.

Trypanosomes generally admitted to be very nearly allied, *e.g.*, *T. pecorum* and *T. congolense*, behave similarly in the fly. Another striking point is that the type of development in the fly for a given species of trypanosome is apparently constant, irrespective of the species of tsetse concerned. These facts indicate that the distribution of the mammalian trypanosomes in the invertebrate host affords valuable evidence in considering the question of diagnosis.

The author points out that Roubaud and his colleagues found that *T. pecaudi* developed in the alimentary canal and proboscis of *G. longipalpis* and *tachinoides*; this fact makes it impossible to suppose that *T. pecaudi* and the subject of this paper are identical. For the present the author refrains from naming the parasite.

Miss Robertson in a note on the life cycle of the trypanosome in the alimentary tract of *G. palpalis* states that in the main the development of this parasite is very like that of *T. gambiense*; nevertheless there are certain differences which serve to distinguish the two forms. The earliest unmistakable development was noted on the 3rd to 4th day of the infection. The trypanosomes had increased somewhat in size and bulk and were extraordinarily uniform in type, the membrane was narrower than in the blood type, the free flagellum was short and the kinetonucleus lay somewhat anterior to the posterior extremity of the body. Division was in active progress and the parasites were present in large numbers in the "hind" and "midgut." The details of division are identical with those in *T. gambiense*. The forms

seen in these early days are always fully developed trypanosomes, and the suppressed crithidial forms described during the earliest divisions of *T. gambiense* (see this *Bulletin*, Vol. 1, p. 267) were never seen in this trypanosome. From the 7th day long slender trypanosomes begin to appear in the gut and about the 14th day they are seen in the proventriculus where they form the predominant and usually, but not always, the only type. At this stage in the cycle there is often a rather strikingly long period during which development does not progress. The salivary glands are finally invaded from the proventriculus by way of the hypopharynx. The slender free-swimming proventriculus forms were seen in the proximal part of the hypopharynx of a fly on the 27th day; the salivary glands were not, as yet, affected. Infection of the mammalian host does not occur until the salivary glands are invaded. The actual development of the trypanosome in the glands resembles that of *T. gambiense*. The gland infections show far higher numbers than in the cycle of *T. gambiense*, but the development in the glands occupied a considerably longer period than is the case with the sleeping sickness organism. The development of the parasite in the fly is illustrated by 36 figures.

Some Attempts to Transmit *Trypanosoma gambiense* by Wild Stomoxys; with a Note on the Intestinal Fauna of these Flies. By H. L. Duke. pp. 89-93.

The flies used in these experiments were *Stomoxys nigra* and *S. calcitrans*. The flies were fed first for varying numbers of days on an infected monkey and then placed daily on clean monkeys until the termination of the experiment at the death of the last remaining fly. None of the monkeys became infected. In all 363 flies were dissected—those dying during the first four days of the experiment were discarded—but although no flagellates having crithidial or trypanosome structure were seen, two interesting organisms were discovered. One was a flagellate showing the structural characters of Bodo; the other a crescent shaped body, which had no motility and was often present in enormous numbers in the fly's gut.

Notes on the Behaviour of a Polymorphic Trypanosome in the Blood-Stream of the Mammalian Host. By Muriel Robertson. pp. 111-119.

This paper deals with the trypanosome described above by Duke. In general the cycle of the parasite in the blood of the vertebrate host was similar to that of *T. gambiense* (see this *Bulletin*, Vol. 1, p. 44). There is a definite general correlation between a high percentage of long forms and a high percentage of division; and there is an equally clear correlation between a high percentage of short forms and a low percentage of division. As in *T. gambiense* the survivors who weather the untoward conditions which carry off the majority of the parasites during the depressed period are drawn from among the short forms. Division is not found in specimens below 20-21 microns in length, and the earliest forms in which any sign of division can be

detected are definitely long forms. The long forms are those about to divide and they produce the short forms, in some cases directly, in others probably upon the intervention of another or several divisions.

W. Y.

Differentiation of Trypanosomes.*

Roubaud (E.). **Evolution comparée des Trypanosomes pathogènes chez les Glossines.**—*Bull. Soc. Path. Exot.* 1913. June. Vol. 6. No. 6. pp. 435-441. With 3 figs.

This paper is an attempt to classify African trypanosomes from their development in Glossina. The behaviour of the parasites in Glossina may be divided into (1) Phenomena of culture, (2) Phenomena of evolution. The former are characterised by the persistence of the virus in the form of trypanosomes, whilst the latter are characterised by the cyclic transformation of the parasite into crithidial forms and then into the typical trypanosome forms. Both may be temporary (abortive) or permanent.

In the phenomena of temporary culture the trypanosomes pass into the posterior part of the midgut in a modified trypanosome form of large size. The culture hardly lasts more than 2 or 3 days. The author has only observed this kind of culture in *T. gambiense*, *T. dimorphon*, *T. congolense* and *T. pecaudi* and never in the case of *T. brucei* (Zululand), *T. congolense*, [This appears to be an error as *T. congolense* is amongst the trypanosomes of the previous group.] *T. cazalboui* and *T. evansi*. Hence one is able to distinguish *T. brucei* and *T. cazalboui* from those of the former group.

This temporary intestinal culture may in certain cases become permanent, characterised by its persistence in the intestinal tract even during fasting. The culture extends from the posterior midgut to the anterior gut. The author has never seen infection of the rectum, cysts, or infection of the Malpighian tubes, but the anterior and midgut may be invaded in its entirety. It is this that the author calls 'infection totale.'

While temporary culture of 24 to 48 hours is constant, permanent culture is observed only in a limited number of flies which varies according to the species of Glossina, the specific character of the virus, and the locality.

Permanent infection of the intestine of Glossina may be considered as a phenomenon of culture, for it is not accompanied by important morphological modifications. The appearances are comparable to those seen in artificial cultures such as are described by Thomson and Sinton (see this *Bulletin*, Vol. 1, p. 53). Moreover, these forms of intestinal cultures are not infective.

The phenomena of evolution are characterised by crithidial transformation in the salivary region. [The expression "milieu salivaire" presumably includes the proboscis as well as the

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* See also Duke, p. 243.

salivary glands.] They may be temporary (abortive) or permanent. The phenomena of permanent salivary evolution are of three distinct types.—(1) That described as *direct fixation in the proboscis.* The parasites became fixed in the wall of the proboscis as short crithidial forms: these multiply and give rise to the typical salivary trypanosomes which lodge in the hypopharynx. (2) That described as *indirect fixation in the proboscis.* Here the proboscis infection is secondary to an "infection totale" of the intestine. *T. dimorphon* and *T. pecaudi* belong to this class. (3) That known as *indirect fixation in the salivary glands.* This is peculiar to the two human trypanosomes *T. gambiense* and *T. rhodesiense.* The author refers to the work of Miss ROBERTSON on the mode of invasion of the salivary glands from the intestine via the proboscis (see this *Bulletin*, Vol. 1, p. 502).

In conclusion the author attempts to group the various pathogenic trypanosomes of Africa according to their method of development in the tsetse fly. He gives the following four fundamental groups. (1) the *cazalboui-vivax* type, (2) the *dimorphon-pecorum* type, (3) the *pecaudi* type, (4) the *gambiense-rhodesiense* type. Reference is made to the statement by BRUCE and his collaborators that *T. rhodesiense* is identical with *T. brucei.* The author states that so far as the monomorphic organism kept at the Pasteur Institute [Zululand strain] is concerned this hypothesis cannot hold, as the organism is incapable of even temporary intestinal culture in Glossina. [This supports the contention of STEPHENS and BLACKLOCK that *T. brucei* (PLIMMER and BRADFORD) is different from that of the Uganda ox, *T. ugandae* (see this *Bulletin*, Vol. 1, p. 662).*]

W. Y.

MACKIE (F. P.). **The Investigation of Protozoal Diseases with Special Reference to the Differentiation of Trypanosomes.**—*Proceedings of the Third Meeting of the General Malaria Committee held at Madras Nov.* 18, 19 *and* 20, 1912. pp. 271-280. 1913. Simla: Government Central Branch Press.

The object of this communication is to indicate lines on which the differentiation of trypanosomes may be undertaken.

Investigation should be carried out under the following headings: 1. Morphological characters; 2. Pathogenicity; 3. Natural transmitting agent; 4. The reservoir. Other less important methods of differentiation are: 5. Cultural characters; 6. Cross immunization; 7. Serum diagnosis; 8. Geographical distribution; and 8. Effect of treatment. The author proceeds to discuss the methods and to apply them to the differentiation of *T. pecorum*, *T. nanum*, *T. uniforme*, *T. vivax*, *T. brucei*, *T. evansi*, *T. ingens*, *T. elephantis*, and *T. gallinarum.*

In two tables are given the points by which these trypanosomes may be distinguished.

W. Y.

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* It might also be explained by the fact that this is a laboratory strain which has not been through the invertebrate host for many years and has in consequence lost the power even to survive in the fly. A. G. B.

Diagnosis.

Heckenroth (F.) & Blanchard (M.). **Recherches sur les Propriétés du Sérum des Malades atteints de Trypanosomiase au Congo français.** — *Bull. Soc. Path. Exot.* 1913. June. Vol. 6. No. 6. pp. 444-447.

The properties in question (protective, attaching, and trypanolytic) have already been worked at, chiefly with the serum of Europeans. The authors undertook the investigation of these properties in a large number of infected and non-infected negroes at Brazzaville. They used a virus brought from the Pasteur Institute, Paris, which killed mice regularly in a few days.

Trypanolytic power.—The trypanosomes and fresh serum were placed in contact at 37° C. for a period not exceeding one hour. Only total or sub-total trypanolysis was considered positive. The results in 172 cases are given. A certain number, 18 per cent., of non-infected gave a positive result, while treated cases gave 44 to 50 per cent. positive and untreated cases 78 to 93 per cent. positive. The greatest proportion of positive results was obtained in untreated cases in a bad physical condition. There is some evidence that the presence of trypanosomes in the blood favours the reaction.

Attaching power.—Inactivated serum, leucocytes and trypanosomes were placed in contact for 20 minutes at laboratory temperature. Only complete attachment was considered positive. The number of positive reactions was 20 per cent., the state of the patient not affecting the result.

Agglutinating power.—This was observed only in 4·8 per cent. of 144 cases; 50 non-infected cases gave no agglutination.

Protective power.—Mesnil and Ringenbach found that normal human serum had a protective power against the strain of *T. gambiense* which the authors were using. In order to avoid this action the sera were kept 10 to 20 days in the ice chest, by which time the normal action had disappeared.

One cubic millimetre of serum was mixed with one-fifth of a cubic millimetre of a dilution of trypanosomes which had ten to the field (Mg. = 350 Diam.). The whole was injected intraperitoneally into rats and mice.

The sera of 50 individuals, of whom 25 had trypanosomiasis, were tested. The normal sera gave no protection; 24 out of 25 infected sera protected. Non-treated cases in an advanced state gave the longest protection, treated cases were less active. Of the latter by only two was complete protection conferred, in six others delay in infection was caused.

The conclusions are:—Protective, attaching, and agglutinating powers are confined to the serum of sleeping sickness patients. Trypanolysis is more frequent with the serum of sleeping sickness patients than with normal individuals.

The different properties do not always co-exist in the same serum. Trypanolytic and protective powers are observed in the serum of patients with trypanosomes in the blood at the time of taking the blood. The serum of infected cases is almost always

protective, frequently trypanolytic, rarely attaching, and very exceptionally agglutinating.

The existence of these properties in the serum has no prognostic value, and only the protective power is of sufficient constancy to assist in the diagnosis of doubtful cases.

W. Y.

MESNIL (F.). **A Propos du Pouvoir protecteur des Sérums des Malades du Sommeil.**—*Bull. Soc. Path. Exot.* 1913. June. Vol. 6. No. 6. pp. 447-451.

The sera of sixteen patients in thirteen of whom trypanosomes had been found, the remaining three being suspected cases of sleeping sickness, were examined as regards their prophylactic action in mice. A brief account of each of the sixteen cases is given.

The various sera were used in doses of from half to 1 cc. Seven of the thirteen sera obtained from the patients in whom trypanosomes had been found protected mice completely against infection. The serum of one of the doubtful cases obtained three days before using protected completely in doses of 1 cc. Fourteen days after removal it only retarded the infection in mice for four days. The sera of the other doubtful cases were without action.

W. Y.

CHEMOTHERAPY.

MORGENROTH & TUGENDREICH. **Zur Chemotherapie der Trypanosomeninfektion.** [On the Chemotherapy of Trypanosomiasis.] —*Berlin. Klin. Wochenschr.* 1913. Feb. 24. Vol. 50. No. 8. pp. 367-368.

The experiments described in this paper are a continuation of the chemotherapeutical experiments which have been carried on for some years, along definite lines, by MORGENROTH, HALBERSTÄDTER, R. LEVY, and KAUFMANN. The authors refer to their own and their colleagues' work on quinine derivatives, especially in relation to pneumococcal infection (MORGENROTH and R. LEVY), and trypanosomiasis in the mouse (MORGENROTH and HALBERSTÄDTER). The present experiments deal with the simultaneous application of several chemotherapeutically active substances which in combination give better results than they do individually. LAVERAN and MESNIL and many other experimenters have worked at this point and EHRLICH especially has frequently pointed out the importance of this fact. The good results obtained by TSUZUKI, who employed a combination of three separate remedies, are referred to (see *Sleeping Sickness Bulletin*, Vol. 3, p. 251).

MORGENROTH and ROSENTHAL observed that salicylic acid had a distinct action in trypanosomiasis. They determined to test systematically a large number of substances, and to raise as far as possible the somewhat feeble action of salicylic acid. This they have succeeded in doing by means of combination methods.

Ethylhydrocuprein was used in combination with sodium salicylate in the treatment of mice infected with nagana. The

quantity of the former drug used was so small as to be in itself of little value in clearing the trypanosomes, as shown in control mice. The latter drug proved in many experiments to have but slight effect on the parasites, even when used in the largest possible doses. The combination of the two caused a temporary clearance of the trypanosomes out of the blood. One mouse was cured (4 months' observation). Quinine itself whether in watery or oily solution proved far inferior to ethylhydrocuprein. A further series of experiments proved a combination of ethylhydrocuprein base, sodium salicylate, and a small quantity of salvarsan to have excellent effects. Salvarsan alone or in comination with sodium salicylate gave poor results, but salvarsan with ethylhydrocuprein gave definitely better effects. The three drugs together, however, given at a single injection cleared the trypanosomes out of the blood of seven mice heavily infected with nagana, and these animals remained free from trypanosomes (observation over 4 months). These excellent results should cause the adoption of the use of quinine derivatives, especially ethylhydrocuprein, and salicyl derivatives as an aid in the treatment of diseases in which at present salvarsan alone is used. The authors consider it justifiable as a result of these experiments to investigate the effect in disease in man of a combination of these three drugs, more especially as they have further found that ethylhydrocuprein frequently injected in small doses has proved capable of preventing relapses in trypanosome infected animals which had been insufficiently treated with salvarsan. This preventive effect occurred in the majority of infected animals, while the controls died after relapses. Should this method be applicable to man, the field of its utility is fairly wide—sleeping sickness, malaria, and possibly syphilis.

W. Y.

Hartoch, Rothermundt, & Schürmann. **Beziehungen zwischen toxischen und chemotherapeutischen Wirkungen der Antimonpräparate im besonderen bei Dourine.** [The Relation between the Toxic and Chemotherapeutic Actions of Antimony Preparations, particularly in Dourine.]—*Centralbl. f. Bakt.* 1. Abt., Ref. 1913. June 14. Vol. 57. No. 14-22. pp. 174*-179*.

The general poisonous effects of antimony are very similar to those of arsenious acid. Irritation of the gastric mucous membrane with vomiting, fall of blood pressure, haemorrhage in the intestinal wall, derangement of the nervous apparatus of the heart and striped muscles, fatty degeneration of the large glands, and paralysis of central nervous origin are all symptoms produced by either arsenic or antimony.

In more recent times the work of Cloetta and his school has added to our knowledge of the action of antimony. In contradistinction to arsenic it is not possible to produce a high degree of tolerance against antimony, and further the amount absorbed (absolutely as well as relatively) rather increases than diminishes with increasing duration of administration. This failure to produce tolerance through repeated administration of antimony—comparable to the failure to produce antimony fast strains of

spirochaetes and trypanosomes—is a point of considerable significance in the estimation of the therapeutic value of antimony. Systematic experiments with various preparations of antimony —trivalent and pentavalent—have demonstrated, according to Brunner, that the toxicity of individual preparations cannot be explained by an especially quick absorption. The poisonous, strongly active compounds and the slightly active show no essential difference in the quantity absorbed. All the highly toxic compounds contain the antimony in the trivalent form and conversely the non-toxic contain it in the pentavalent form. This relation between valency and toxicity is not peculiar to antimony, but applies in the case of other elements.

Trixidin (antimony trioxide) is a striking exception in that although it contains the antimony in the trivalent form and is of great therapeutic activity it is nevertheless almost non-poisonous to mice, rats, guineapigs and rabbits (see this *Bulletin*, Vol. 2, p. 134). How far the larger animals and man will prove to be tolerant is, as yet, unknown. This question is of great importance since the larger animals are usually less tolerant to the various medicants, *e.g.*, atoxyl, used in the therapy of trypanosome infections. In view of the fact that 100 mgm. of trixidin can be given per 10 gm. of body weight without producing symptoms of acute poisoning in mice, and that permanent sterilisation is caused by one hundredth part of this dose, it can be assumed that the question of tolerance is no serious objection to the employment of the remedy in large animals and man. Experiments are to be undertaken to decide the point.

Mice, rats, guineapigs and rabbits infected with dourine were treated with trixidin or dimethylphenylpyrazolon-antimony ointment and the results obtained were as successful as in the case of infection with nagana and *T. gambiense* (*loc. cit.*). A couple of thorough inunctions of the above ointment caused the trypanosomes to disappear from the peripheral blood by the next day. As a rule there was no relapse.

No antimony was discovered in the organs of animals which had received an intramuscular injection of trixidin, except in the muscles into which it had been injected. Here it was visible macroscopically.

The paper concludes with the remark that intramuscular injections of trixidin and the inunction of metallic antimony or other insoluble compounds far surpass in efficacy all hitherto described remedial measures for trypanosomiasis.

W. Y.

Lamballe (F. W.). **Trypanosomiasis and Surra. A Preliminary Note upon the Effect of Pancreatic Enzymes upon the Trypanosome of Surra. With an Explanatory Note by J. Beard, D.Sc.** —4 pp. 1913. June 9. Edinburgh: Otto Schulze & Co.

Lamballe treated three mules heavily infected with *T. evansi* with 3,750 units of Trypsin and 1,000 units of Amylopsin on each of two consecutive days. Three days later only parasites in various stages of disintegration were found in the blood films.

The next day no trypanosomes were seen. [As there is no record of further observations, no conclusion of value can be drawn from this note.]

W. Y.

Tsetse Flies.

Macfie (J. W. Scott). **The Distribution of Glossina in the Ilorin Province of Northern Nigeria.** — *Bull. Entomol. Research.* 1913. May. Vol. 4. Pt. 1. pp. 1-28. With 7 plates and 1 map.

During the year 1912 the author made a systematic study of the distribution of tsetse in the Ilorin province of Southern Nigeria. This district is approximately 6,300 square miles in extent and supports a population of some half million people. It lies in the south western portion of Northern Nigeria. An account of the physical features and climatic conditions is given.

In all 612 collections of tsetses were made from more than 500 different localities which are indicated on a map constructed by the author. The species noted were *G. palpalis, G. tachinoides, G. submorsitans* and *G. longipalis.* The first two species occurred in all districts of the province, whilst *G. submorsitans* was limited to the eastern division.

The western division.—*G. palpalis* and *G. tachinoides* were the only species noted in this division. As a rule no distinction could be detected in the haunts of these insects, but on the Weru River *G. tachinoides* were found feeding on the author's horse in an open space some distance from the river where there were many *G. palpalis.*

In spite of the general occurrence of tsetse numerous herds of Fulani cattle are found throughout the greater portion of this division. It would be a matter of no great difficulty to render the roads almost everywhere comparatively free from tsetse fly owing to the relatively small numbers of these insects and the strict localisation of their haunts.

The eastern division.—All four species were found in this district, but *G. longipalpis* was only taken in a few widely separated localities; although tsetse haunt practically every river of the western district and nevertheless cattle are abundant, no Fulani herds are found in this division except in the extreme western portion. The author points out that there is one great difference between the two districts: whereas *G. morsitans* occurs all over the eastern district it is apparently absent from the western. He considers that it is this species which is inimical to live stock.

The southern division.—*G. palpalis* and *G. tachinoides* only were found. The former appears to be distributed all over the district, whilst the latter was caught at but a few places.

The small race of G. palpalis *found in Ilorin.*—This is by far the most common tsetse fly in Ilorin and although it differs markedly in external characters from any recognised species it

has been identified by both NEWSTEAD and AUSTEN as *G. palpalis*. It is a small fly with abdominal markings practically identical with those of *G. tachinoides*, with the exception that the buff colour of the paler areas is replaced by a very characteristic grey-blue tint. The male genitalia are identical with those of *G. palpalis*. Tsetse flies of this type were collected from every part of the province and were often found associated with typical *G. palpalis* and *G. tachinoides*. A coloured plate of the fly is given.

Mites found on tsetse flies.—In a few specimens of both *G. palpalis* and *G. tachinoides* minute red mites were found attached to the abdomen, thorax and legs. They were of two distinct types and probably belong to the genus *Trombidium*.

Fulani cattle.—Tables are given of the distribution of cattle in the Ilorin province. In addition to Fulani cattle a few dwarf cattle are met with in the southern and south-eastern districts. They are found in the neighbourhood of villages and towns in districts where Fulani cattle cannot exist, and have therefore been credited with a natural immunity to trypanosomiasis. The author found, however, that they succumb to infection with *T. brucei*, although in two cases recovery from infection with *T. vivax* was observed to occur.

Trypanosomiasis.—In Ilorin province human trypanosomiasis is either very rare or altogether absent. This may be due to the fact that the native population is relatively immune to the disease, or to the absence of the species of trypanosome which are pathogenic to man. The comparative scarcity of game, which has been proved by KINGHORN and YORKE to be the reservoir of sleeping sickness in Rhodesia, should also be remembered in considering this subject. Trypanosomiasis of domestic animals is exceedingly common. Trypanosomes presenting the morphological characters of *T. brucei* (probably *T. ugandae* of STEPHENS and BLACKLOCK), *T. vivax*, *T. nanum* or *T. pecorum*, and *T. theileri* were found. The paper closes with some suggestions as to the manner in which trypanosomiasis might be dealt with in this province.

A synopsis in tabular form is given of localities in which the various tsetse flies were taken.

W. Y.

ROUBAUD (E.). **Supplément à la Répartition et à la Variation Géographique des Glossines.**—*Bull. Soc. Path. Exot.* 1913. May. Vol. 6. No. 5. pp. 347-350.

The author has revised the collections of Glossina at the Pasteur Institute and Paris Museum.

The great majority of tsetse from the French Congo are *G. tabaniformis* Westwood. True *fusca* is rare in the Congo.

In West Africa *G. fusca* is widely distributed on the Ivory coast and *G. nigrofusca* and *G. medicorum* are also found in this district. The last species also occurs in Dahomey, where it is met in the same places as *G. palpalis* and *G. tachinoides*.

Among the *morsitans* group are two examples of *G. austeni* which were taken in 1906 in Mozambique. An examination was

made of the male armatures of *G. morsitans* from West Africa, Chad, Nyasaland, and from the valley of the Limpopo. *G. morsitans* from West Africa and those from Chad are a different variety from those of East Africa. The name *submorsitans* proposed by NEWSTEAD (*Sleeping Sickness Bulletin*, Vol. 3, p. 80) may serve to distinguish the western variety from the other. The distinction between these two geographical sub-species is analogous to that which exists between the eastern *G. pallidipes* and the western *G. longipalpis*.

G. palpalis also vary in different localities. Those from West Africa are larger (9-10 mm.) and of dark colour and the superior claspers are highly developed, while those from East Africa are smaller and of a lighter colour. The species described by Newstead as *G. fuscipes* ought to be regarded as a geographical variety of *palpalis*. This form appears frequently in Uganda and it is also represented in the collection at the museum, the specimens having come from the Belgian Congo.

W. Y.

NEWSTEAD (R.). **A New Tsetse Fly from the Congo Free State; and the Occurrence of *Glossina austeni* in German East Africa.**—*Ann. Trop. Med. & Parasit.* 1913. June 10. Vol. 7. No. 2. pp. 331-334.

A description is given of a new species of tsetse fly from the Congo, *Glossina severini*, of which two examples were available.

The author remarks that the species can be easily separated from *G. fusca* by the much darker colour of the pleura and the hind coxae; in these characters it resembles *G. fuscipleuris*, but it has relatively longer and stouter palpi and is also distinguished from the latter by its darker and more uniformly coloured hind tarsi.

The male genital armature of *G. severini* resembles closely that of *G. medicorum*, but it can be separated from the latter by its rudimentary harpes, the greater length of the marginal hairs of the editum, and by the greater length of the lateral branches of the hairs of the arista.

There are figures of the male armature of *G. severini* and of the terminal portions of the hairs of the arista of this species and of *G. medicorum*.

The author records that he has obtained twelve examples (2 ♂ and 10 ♀) of *G. austeni* (this *Bulletin*, Vol. 1, p. 523) from the Tanga district of German East Africa.

W. Y.

SHIRCORE (J. O.). **On Two Varieties of *Glossina morsitans* from Nyasaland.**—*Bull. Entomol. Research.* 1913. May. Vol. 4. Pt. 1. p. 89.

Glossina morsitans, Westw., var. *pallida*. nov.

The colour markings of this tsetse—a male taken in the Dowa district of Nyasaland—are described in detail. The author remarks that the fly was picked out at a glance from more than

a hundred *G. morsitans* and is distinctly and remarkably paler throughout. The last two joints of the hind tarsi are faintly dark, but not nearly so dark as in *G. morsitans.*

In a footnote it is stated that there is in the British Museum a single male (also from the Dowa district) which agrees entirely with this specimen. The genitalia are indistinguishable from those of typical *G. morsitans.*

Glossina morsitans, Westw., var. *paradoxa.* nov.

This specimen—a male—which was caught in the same district resembles superfically *G. morsitans,* but the hind tarsi are entirely dark as in the *palpalis* group. The superior claspers of the male genitalia resemble those of *G. submorsitans,* but are more deeply pigmented throughout, especially along the lateral and posterior borders.

W. Y.

Trypanosoma Cruzi Infection.

Chagas (Carlos). **Les Formes Nerveuses d'une Nouvelle Trypanosomiase (*Trypanosoma cruzi* inoculé par *Triatoma magista*) (Maladie de Chagas).** — *Nouvelle Iconographie de la Salpêtrière.* 1913. Jan.-Feb. Vol. 26. No. 1. pp. 1-9. With 7 plates.

This paper is a résumé of the author's observations on the nervous manifestations of the disease called after him. Most of the observations recorded have already been dealt with in previous papers (*Sleeping Sickness Bulletin,* Vol. 4, p. 341, and this *Bulletin,* Vol. 2, p. 138). Writing on the frequency of the nervous forms of the infection the author says "We have numerous observations, which entitle us to state that this malady is the one which causes perhaps the greatest number of organic affections of the nervous system in human pathology."

A case of cerebral spastic paraplegia is described in detail in which there were also symptoms of cerebellar origin.

The paper is illustrated by numerous photographs.

W. Y.

Brumpt (E.) & Gonzalez-Lugo. **Présentation d'un Réduvide du Vénézuela, le *Rhodnius prolixus* chez lequel évolue *Trypanosoma cruzi.*—*Bull. Soc. Path. Exot.*** 1913. June. Vol. 6. No. 6. pp. 382-383.

Trypanosoma cruzi was found in the faeces of *Rhodnius prolixus* more than two months after they had been fed on an infected monkey.

The authors write that if *Rhodnius prolixus* maintains its infection indefinitely as does *Conorhinus megistus,* and not during some months only as *Cimex lectularius* and *Cimex rotundatus,* these insects are still more to be feared than the *Conorhinus.* For whereas the latter does not defecate as a rule for some seconds or even minutes after feeding, the *Rhodnius*—both larvae

and nymphs—defecates immediately after having withdrawn its proboscis, and hence the individual bitten has much more chance of being infected.

Rhodnius prolixus swarms in certain portions of Venezuela, Columbia, and the adjoining countries.

W. Y.

Unclassed.

Heckenroth (F.) & Blanchard (M.). **Transmission du *Trypanosoma gambiense* par des Moustiques (*Mansonia uniformis*).**—*Bull. Soc. Path. Exot.* 1913. June. Vol. 6. No. 6. pp. 442-443.

Experiments were conducted at Brazzaville, French Congo, to ascertain whether the mosquito (*Mansonia uniformis*) could transmit *T. gambiense*. [See *Sleeping Sickness Bulletin*, Vol 1, p. 70.]

A mosquito proof cage was divided into two compartments by a partition which extended about two thirds the height of the cage. Into each of these a guinea-pig was placed—one infected and the other normal. Mosquitoes were then introduced into the cage. After 48 hours the healthy animal was withdrawn. It subsequently was found to be infected.

In a second experiment 26 hungry *Mansonia* were allowed to feed on a heavily infected guineapig. After 24 hours the infected animal was withdrawn and 24 hours later a healthy guineapig was introduced into the cage. After a further interval of 23 hours this was also withdrawn. It subsequently showed trypanosomes in the peripheral blood.

This experiment shows *Mansonia* can retain the power of infecting for at least 24 hours.

W. Y.

Todd (John L.). **Concerning the Sex and Age of Africans suffering from Trypanosomiasis.**—*Ann. Trop. Med. & Parasit.* 1913. June 10. Vol. 7. No. 2. pp. 309-319.

Of the 79 cases of trypanosomiasis seen by the author in the Gambia (*Sleeping Sickness Bulletin*, Vol. 3, p. 336), 76 per cent. (39·3 per cent. males and 36·7 females) were adults and 24 per cent. children (16·4 per cent. boys and 7·6 per cent. girls); none were aged.

Slight degree of glandular enlargement is common in children of both sexes. Much enlarged '+' glands occur most often in young adults and trypanosomes were found in every person with much enlarged glands who was examined for them.

Almost 90 per cent. (60 per cent. males and 30 per cent. females) of the 416 cases of trypanosomiasis seen by Dutton and the author in the Congo were young adults. With the exception that the percentage of infected young people is greater, the incidence of trypanosomiasis in the Gambia differs slightly from that in the Congo.

The rareness of the disease amongst old people is striking. Even although a large proportion of adults infected with trypanosomiasis and untreated die within 3 or 4 years and although the aged are not exposed to infection by their occupation, it is astonishing that the percentage of infected old persons should be so small; it seems impossible that even so small a number of persons could live during their years among populations so heavily infected without themselves contracting the disease. The only explanation which suggests itself is that some natives may be immune to trypanosomiasis. If an immunity does exist it is probably not an absolute 'sterilizing' immunity, but a relative one in which the host is tolerant of the infecting parasite.

The following are the conclusions:—

1. The proportion of elderly individuals among the natives of the Congo and Gambia is lower than it is among Europeans.
2. By far the majority of cases of trypanosomiasis are persons of middle age; almost none of them are elderly persons.
3. The percentage of individuals with a considerable degree of glandular enlargement—which is coincident with trypanosomiasis—is very much greater in adults, and in children, than in elderly persons.
4. It is possible that the low incidence of trypanosomiasis among elderly persons may be due, in part at least, to an immunity acquired by them.

W. Y.

McCowen. **A Note on Sleeping Sickness in Principe Island and Angola, West Coast of Africa.**—*Proc. Roy. Soc. Med.* (*Sect. of Epidemiology & State Med.*) 1913. May. Vol. 6. No. 7. pp. 191-194.

This paper gives a brief account of Sleeping Sickness in Principe and Angola.

In a footnote Bassett-Smith states that the great majority of the tsetse collected by McCowen were *Glossina palpalis*. There were two specimens of the variety *G. palpalis wellmani* and one example of *G. medicorum* which is new to the district.

W. Y.

Hirsch (Rahel). **Trypanosomen-Wärmestich-Anaphylatoxinfieber beim Kaninchen.** [Trypanosome-Isolation-Anaphylatoxin Fever in Rabbits.] — *Zeitschr. f. Exper. Patholog. u. Therapie.* 1913. Apr. 24. Vol. 13. No. 1. pp. 132-142.

The author gives an account of experiments which she undertook in connection with heat production, oxygen absorption, and carbonic acid excretion in experimental animals. Rabbits were used and the condition of fever produced by infection with trypanosomes, insolation, and anaphylatoxin. Heat production was tested by the direct method, and the absorption of oxygen and excretion of carbonic acid at the same time ascertained. The calorimeter was put at 15·8° C., as in all previous experiments. Rabbits give a very regular curve of heat production, so that animals of the same body weight on an equal diet give practically identical curves.

The results of the experiments are clearly set out in 28 tables and the conclusions are as follows:—

1. Fever due to infection such as is caused by trypanosomes evokes in Rabbits an increased heat production.
2. Insolation also brings about an increase in heat production which is slighter than that observed in Trypanosome fever.
3. In Anaphyatoxin fever even with high temperature the heat production in Rabbits may fall far below the normal.

W. Y.

HIRSCH (Rahel). **Fieber und Chininwirkung im Fieber.** [Fever and the Action of Quinine in Fever.]—*Zeitschr. f. Experiment. Patholog. u. Therapie.* 1913. Apr. 24. Vol. 13. No. 1. pp. 84-131.

This is a highly technical paper dealing with metabolism and heat production in fever, and the effects of quinine administered during the continuance of the fever upon them. A summary of previous work done on this and kindred subjects is given. The author's own observations were made upon two dogs. These were put on a fixed diet and studied in the state of health. They were then inoculated with pathogenic trypanosomes, Nagana in one case and *T. brucei* (PROWAZEK'S) in the other, and were studied during the febrile period which lasted with short intermissions until their death.

Details of diet, technique, and apparatus used are fully given and the results are summarized clearly in Tables. [Those interested in the subject of metabolism should read this paper in the original.]

W. Y.

BROWN (Alexander). **Native Treatment of Sleeping Sickness—A Trial.**—*Jl. Trop. Med. & Hyg.* 1913. June 2. Vol. 16. No. 11. p. 167.

The remedy, a decoction of the bark of a tree called "Musolkwe," was found to be of no value.

W. Y.

KOHL-YAKIMOFF (Nina), YAKIMOFF (W. L.), & SCHOKHOR (N. J.). **Le Trypanosome des Bovidés (*Tr. theileri* ou du Type voisin) au Turkestan.**—*Bull. Soc. Path. Exot.* 1913. June. Vol. 6. No. 6. p. 434.

Cattle in Turkestan are heavily infected with *Theileria mutans*, but the authors were unable to find in the peripheral blood *Trypanosoma theileri*, although they examined 154 animals in the municipal slaughterhouses of Taschkent. No person, they state, has seen these flagellates in this district. By means of inoculating tubes of ordinary broth with blood from the jugular vein, cultures were obtained from 8 animals out of 9. The amount of blood used was 4-5 cubic millimetres per tube.

W. Y.

KOHL-YAKIMOFF (Nina), YAKIMOFF (W. L.), & BEKENSKY (P. W.). **Le Trypanosome des Bovidés (*Tr. theileri* ou du Type voisin) en Russie d'Europe.**—*Bull. Soc. Path. Exot.* 1913. June. Vol. 6. No. 6. pp. 433-434.

The authors worked at St. Petersburg with cattle (from the provinces of Witebsk and Pskow), in which parasites were not visible in the peripheral blood. They used the method of Ed. and Et. SERGENT. Cultures were obtained from 5 of 14 animals examined. The culture was easily carried on from broth to the NNN medium for several generations. Finally, they inoculated the broth cultures into a calf and this became infected.

W. Y.

LAVERAN (A.) & FRANCHINI (G.). *Trypanosoma talpae* **chez** *Palaeopsylla gracilis.—Compt. Rend. Soc. Biol.* 1913. June 20. Vol. 74. No. 22. pp. 1254-1256. With 11 text-figs.

The authors examined the fleas, *Palaeopsylla gracilis,* found on moles, and in 10 out of 36 found flagellates which they consider cultural forms of *Trypanosoma talpae* in the digestive tract of the fleas. Parasitised fleas were taken, 8 out of 10 times, from moles in which *T. talpae* was found. The stages of the parasite encountered are described as (1) small, free, oval elements; (2) fusiform elements, sometimes with signs of bipartition in their nuclei and often forming rosettes containing a variable number of organisms; (3) Leptomonas-like forms; (4) typical small trypanosomes with a somewhat straight undulating membrane. The various phases recall those of *T. lewisi* in the rat flea. The authors recognise the existence of natural flagellates of fleas but consider that the presence of definite small trypanosomes excludes their organism from the category of natural flagellates. The authors illustrate each form of organism described.

A. Porter.

PROTOZOOLOGY.

RODHAIN (J.), PONS (C.), VANDENBRANDEN (F.), & BEQUAERT (J.). **Notes sur quelques Hématozoaires du Congo Belge.**—*Arch. f. Protistenkunde.* 1913. Apr. 19. Vol. 29. No. 2. pp. 259-278. With 1 plate and 5 text-figs.

The authors describe briefly various Haematozoa found by them on their journey from Leopoldville to Katanga, Belgian Congo. The parasites include trypanosomes from two genera of mammals and five of birds; haemogregarines from three genera of snakes, from one *Varanus niloticus* and from one *Bufo* sp., while 3 genera of mammals were also parasitised; a *Leucocytogregarina* from the jackal, *Canis adustus*; a new *Plasmodium* from the insectivore *Petrodromus tetradactylus*, both gametocytes and schizonts being described; *Halteridium* and *Haemoproteus* from 22 different genera of birds; and Leucocytozoa from 14 avian genera. Full lists of the respective hosts are given, together with brief details regarding the parasites.

A new trypanosome from the Macroscelid insectivore *Petrodromus tetradactylus* is designated *T. brodeni*, but the avian trypanosomes are grouped according to their hosts only. The same applies to the haemogregarines, halteridia and Haemoproteus. Of the Leucocytozoa, that from the great heron, *Ardea goliath*, is termed *Leucocytozoon ardeae*, and that from the fowl, *L. schoutedeni*. No new name is given to the others described, the authors remarking [and most justly] that until the mode of transmission is known [as well as their full developmental cycle] new names must be considered as provisional only. The paper is well illustrated.

H. B. Fantham.

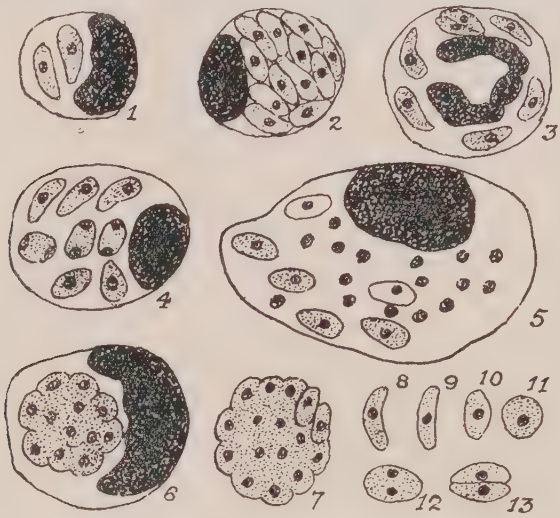
i. LAVERAN (A.) & MARULLAZ (M.). **Contribution à l'Etude morphologique du *Toxoplasma gondii* et du *T. cuniculi*.**—*Compt. Rend. Acad. Sci.* 1913. Séance du 28 Apr. Vol. 156. No. 17. pp. 1298-1302.

ii. LAVERAN (A.). **Présentation d'un Chien infecté de Toxoplasmose.**—*Bull. Soc. Path. Exot.* 1913. May. Vol. 6. No. 5. p. 294.

iii. LAVERAN (A.) & MARULLAZ (M.). **Recherches expérimentales sur le *Toxoplasma gondii*.**—*Ibid.* June. No. 6. pp. 460-468.

i. The authors consider the morphology of these species separately. (1) *Toxoplasma gondii* was studied in peritoneal exudate and smears of organs. The uninucleate parasite is usually oval but its shape and size may vary. The length is 2·5 μ to 6 μ, and the breadth is 2 μ to 3 μ. Multiplication is by binary fission.

The parasites occur in mononuclear and polymorphonuclear leucocytes, the endothelial cells of the peritoneum and splenic capillaries, and in hepatic cells [vide diagrams]. The number of parasites in a host cell may be few or as many as 30. Pseudocysts are aggregations of parasites. 13 text figures are given.



Toxoplasma gondii, endocellular or free in the peritoneal exudate of infected mice.

1. Mononuclear containing two toxoplasms. 2. Mononuclear filled with toxoplasms. 3. Polynuclear containing toxoplasms. 4. Endothelial cell containing toxoplasms, three of which are dividing. 5. Endothelial cell containing toxoplasms, some with clear outline and others of which the nuclei only are seen. 6. Endothelial cell with agglomerated toxoplasms. 7. Agglomeration of toxoplasms; the contours of two are seen. 8–11. Free toxoplasms. 12–13. Division stages. (Magnification about 1,600 diameters.)

(2) *Toxoplasma cuniculi.*—The dimensions are much the same. The authors cannot agree with SPLENDORE who thought that some specimens possessed a blepharoplast and flagellum, nor do they agree with his and CARINI'S account of multiplication by schizogony.

Laveran and Marullaz consider that there is insufficient evidence from the morphological side to justify the separation of the two species.

ii. Laveran exhibited a young dog successfully inoculated intravenously with diluted peritoneal exudate from a mouse infected with *Toxoplasma gondii.* For the first month the dog lost weight, then gained again. The cornea gradually became opaque but total opacity did not occur; purulent mucous discharge came from the nostrils. Very few parasites have been seen, though one leucocyte contained nine. Laveran points out that it is of interest that canine toxoplasmosis causes temporary corneal opacity as in some trypanosomiases.

H. B. F.

iii. This paper contains a full account of the various animal reactions of *Toxoplasma gondii*, as investigated by the authors. Details of each case are given. The authors have successfully inoculated the mouse, *Mus sylvaticus*, *Microtus arvalis*, the rabbit, guinea-pig, mole, hedgehog, shrewmouse, dog, pigeon, and *Padda oryzivora* with *Toxoplasma gondii*. They have failed to reproduce the disease in the rat, dormouse, fowl, several exotic passerines, frogs and lizards. Previously the authors have considered that *T. gondii* and *T. cuniculi* are identical from the similar morphology of the two organisms (see this *Bulletin*, Vol. 2, p. 52). They are strengthened in this opinion by the similarity of the animal reactions, each virus showing the same pecularities, *e.g.*, inoculability to animals belonging to different classes (mammals and birds), and the susceptibility and refractoriness respectively of such nearly allied animals as the mouse and the rat.

A. Porter.*

SPLENDORE (A.). **Des Formes flagellées et des Gamètes dans le** *Toxoplasma cuniculi.—Bull. Soc. Path. Exot.* 1913. May. Vol. 6. No. 5. pp. 318-323. With 1 plate.

Splendore refers to his previous notes on *Toxoplasma cuniculi* in which he expressed a belief that the organism had a flagellate stage. He has now seen in the liver smears of an infected pigeon a parasite possessing what he describes as a filament, which passes along the convex edge of the parasite, makes a slight curve, traverses the attenuated extremity of the body and is free for about 14 μ. Its appearance suggested a malarial microgamete, but it is not of this nature, since Splendore has seen what he considers as undoubted gametes in smears of the pectoral muscles of a pigeon. The infected breast muscles showed greyish white spots and various stages of Toxoplasma were infiltrated therein. The parasites were found in dry smears stained with Giemsa. They reach 10 μ in diameter and are roundish, while ordinary forms are 7 to 8 μ by 2 to 3 μ. The cytoplasm is attenuated and contains rodlets of chromatin explained as the result of nuclear reduction. Some showed two, others four nuclei, the results of division of the primitive nucleus. Two chromatoid filaments arise near the nuclei and sometimes reach 3 to 4 μ beyond the body. By analogy with the malarial parasites, Splendore considers that the flagellate forms represent microgametes. He does not at present definitely state which are the female forms. In conclusion he states that the above suppositions will be verified when the sexual forms are found in the invertebrate host, which he has incriminated as a Stomoxys.

H. B. F.

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*Dr. A. PORTER is in charge of the Protozoological Section during Dr. FANTHAM's absence in Khartoum.

MESNIL (F.) & SARRAILHÉ (A.). **Toxoplasmose expérimentale de la Souris; Passage par les Muqueuses; Conservation du Virus dans le Cadavre.**—*Compt. Rend. Soc. Biol.* 1913. June 27. Vol. 74. No. 23. pp. 1325-1327.

The authors worked with *Toxoplasma gondii*, using a strain from NICOLLE and Mme. CONOR. The first experiments were to determine whether toxoplasms could traverse the uninjured mucosa of mice. In a preliminary experiment a drop of ascitic fluid was placed in the vagina and on the conjunctiva respectively of two mice, both of which became infected. The table shows the results of the subsequent experiments.

Mucous Membrane.	Results.		Average Duration
	Positive.	Negative.	of Infection.
Vagina	4	0	10 days.
Prepuce	0	2	—
Conjunctiva	1	0	13 and a half days.
Vagina and conjunctiva	2	0	10 days.
Mouth	2	1	14 and a half days.

Every precaution was taken to avoid lesions of the mucosa. The toxoplasms, though able to penetrate the mucosa, were unable to pass through the uninjured skin. Generalised infection followed infection per mucosa and the incubation period was extended. The quantity of virus inoculated made but little difference to the period necessary for a fatal effect. All the organs of the mice showed some toxoplasms but abundance of parasites occurred in the thymus and hypertrophied lymphatic glands.

Local inflammation accompanied vaginal infection. Seropurulent, viscous liquid containing leucocytes and free or intracellular toxoplasms exuded some days after the introduction of the virus. The contained parasites had not lost their virulence.

Ascitic fluid retained its virulence till about eighteen hours after the death of the host; on one occasion it persisted for 30 hours.

A. P.

MARULLAZ (M.). **Au Sujet d'un Toxoplasma des Oiseaux.**—*Bull. Soc. Path. Exot.* 1913. May. Vol. 6. No. 5. pp. 323-326.

The author has studied the small parasites that coexist in *Padda oryzivora* infected with *Haemamoeba danilewskyi* and were previously noted by LAVERAN, ADIE, and de BEAUREPAIRE-ARAGAO. He considers the parasite to be a new species of Toxoplasma. He states that its occurrence in birds quite free from *H. danilewskyi* and other haemotozoa, its endoleucocytic habit, its method of multiplication and absence of pigment, makes it impossible to consider it an avian Haemamoeba, while its multiplication differentiates it from the haemogregarines.

On the other hand, the form of the organism, its dimensions, staining reactions, nuclear structure, longitudinal division, and presence in the mononuclear leucocytes of the viscera and the

blood, permit its inclusion in the genus Toxoplasma. Attempts to inoculate the parasite to the pigeon and mouse failed. This, together with absence of crescent-shaped parasites, serves to differentiate it from *T. gondii* and *T. cuniculi*. The author therefore names it *T. avium*. The paper is illustrated by 9 text-figures of *T. avium*.

H. B. F.

SANGIORGI (Giuseppe). **Un Nuovo Protozoo Parassita del** *Mus musculus*.—*Pathologica*. 1913. June 1. Vol. 5. No. 110. pp. 323-325.

The author briefly discusses the genus *Toxoplasma*, and the species known at present, namely *T. cuniculi*, *T. gondii*, *T. canis* and *T. talpae*.

Sangiorgi found a toxoplasm in the mouse, *Mus musculus*, especially in the spleen and liver; it was absent from the blood. It was usually extracellular, rarely in mononuclear elements, measuring about 3·5 μ in diameter, and rather smaller than allied species. Its shape was round, oval, pyriform, reniform or crescentic. There was a single nucleus in non-dividing forms. The author names the parasite *Toxoplasma musculi*. There are 12 text-figures, some showing longitudinal bipartition.

H. B. F.

i. PHISALIX (M.) & LAVERAN (A.). **Sur une Hémogrégarine nouvelle, de** *Lachesis alternatus*.—*Bull. Soc. Path. Exot.* 1913. May. Vol. 6. No. 5. pp. 330-333. With 12 text-figs.

ii. PHISALIX. **Sur une Hémogrégarine du Python molure et ses Formes de Multiplication endogène.**—*Compt. Rend. Soc. Biol.* 1913. May 23. Vol. 74. No. 18. pp. 1052-1054.
iii. **Sur une Hémogrégarine de la Vipère Fer de Lance et ses Formes de Multiplication endogène.**—*Ibid.* June 20. No. 22. pp. 1286-1288. With 11 text-figs.

i. A new haemogregarine designated *Haemogregarina roulei* occurring in the blood of the viper, *Lachesis alternatus*, is described by the authors. Three forms of parasites occur within the erythrocytes:

1. Small forms, generally two or three at least in each infected cell. 2. Medium sized forms. 3. Large forms representing the adult parasites. Free forms are represented by: (*a*) very small vermicules, and (*b*) large adult forms.

No multiplicative stages have been found in the circulating blood, and the death of the host is awaited before search of the internal organs can be made.

It is interesting to note that as many as five parasites may be enclosed within one erythrocyte.

The text figures illustrate various aspects of *H. roulei* in the blood of the host.

ii. The subject of research was *Haemogregarina pococki* (Sambon and Seligmann) in *Python molurus*. The parasite is closely allied to the haemogregarine described by LAVERAN and PETTIT in *Python sebai*.

Endoglobular, free and multiplicative forms are figured, and their dimensions given. Multiplication cysts are only found in the hepatic capillaries. The cysts are ovoid or spherical, and may contain four merozoites. Haemogregarines also occur in the large pigmented elements of the hepatic capillaries.

The paper is illustrated by 15 text figures, showing the various forms described.

H. B. F.

iii. A haemogregarine was observed by Phisalix in the blood of one of two specimens of the viper, *Lachesis lanceolatus* (= *Trigonocephalus lanceolatus*, Oppel, *Bothrops lanceolatus*), received at the serpentarium of Butantan, Brazil. Larvae of worms in the perivisceral conjunctive tissue, large colourless nematodes from the oesophagus and stomach and minute nematodes from the intestine yielded no stages of the haemogregarine.

Endoglobular forms usually occurred singly in the red cells. If two or three parasites were present, the host cell hypertrophied; if one parasite only were present no change of size or shape usually occurred. The parasites commonly were recurved within the cell. Free forms were vermicular and were sometimes encapsuled, sometimes naked. Multiplication by cysts of the parasite is described for the first time, a few cysts having been seen in capillaries of the liver when sectioned. The encysting organism increases in size, its contents become very granular, and two to four nuclei may be present within the thick wall. Two macromerozoites have been found in ripe cysts. It is very rare indeed to find such cysts, which at first were undetected and hence are not depicted.

A. P.

THIROUX (A.). **Les Formes de Reproduction par Schizogonie et Sporogonie d'*Haemogregarina pettiti* (Thiroux, 1910) chez *Crocodilus niloticus*.**—*Bull. Soc. Path. Exot.* 1913. May. Vol. 6. No. 5. pp. 327-330. With 10 text-figs.

The author refers to his previous paper (1910) on *Haemogregarina pettiti* occurring in the crocodile of St. Louis, Senegal. He now has found in the liver of the host that two forms of cysts occur. The first form is thickwalled and is considered by the author to be an oöcyst containing four ovoid spores, each of which may form two sporozoites. The second form consists of cysts containing eight merozoites distributed irregularly within, such cysts forming the schizogonic cycle.

The author thinks that he has thus demonstrated the occurrence of schizogony and sporogony within the vertebrate host, without the aid of an invertebrate transmitter.

The text figures illustrate the two kinds of cysts described.

H. B. F.

MOLDOVAN (J.). **Sur le Développement du** *Leucocytozoön ziemanni* **(Laveran).**—*Bull. Soc. Path. Exot.* 1913. June. Vol. 6. No. 6. pp. 428-429.

Moldovan examined the internal organs of two owls, *Athena noctua,* heavily infected with *Halteridium noctuae* and *Leucocytozoön ziemanni.* In stained specimens he found in addition to typical gametes, forms which he considers to be schizonts of *L. ziemanni.* They occur in mononuclear cells (lymphocytes or erythrocytes), and in lung and brain smears, all stages from uninucleate forms to schizonts containing 30 nuclei were seen. Merozoite formation, however, was not observed. Some young parasites present were considered to be gametes because of their staining reactions. Trypanosomes described as male and female occurred in the same films. The schizonts were assigned to the genus *Leucocytozoön* rather than to that of *Halteridium* (which was also present in the hosts) on the grounds of the form and structure of the host cells and of the parasite before division, and their resemblance to forms described by other workers for the Leucocytozoa of fowls.

A. P.

FRANCHINI (G.). **Nouvelle Contribution à l'Etude de** *Haemocystozoön brasiliense.*—*Bull. Soc. Path. Exot.* 1913. May. Vol. 6. No. 5. pp. 333-336. With 5 text-figs.

Franchini has confirmed his previous opinion (see this *Bulletin,* Vol. 2, p. 46) that *Haemocystozoön brasiliense,* parasitic in the blood of man, belongs to the Flagellata. He has found non-flagellate and encysted stages of the parasite in smears of blood obtained from liver puncture. He describes and sketches:

1. Oval or lanceolate forms, measuring 3 μ to 6 μ long by 1 μ to 2·5 μ broad. They possess neither blepharoplast nor flagella.

H. brasiliense. The figure on the right is from a coloured plate.

2. Oval or more often lanceolate forms, sometimes seen dividing, some reaching 16 μ in length and 3 μ in width, most being 12 μ long.

3. Flagellate forms with flagella up to 20 μ long, arising near the blepharoplast.

4. Non-flagellate parasites of various forms and dimensions. Some are in process of division. All possess a voluminous nucleus.

5. Forms described as encysted have the size of a red cell, show two chromatin masses in their cytoplasm and numerous chromophile granulations. In other cases, nuclei of various forms and shapes occur.

Franchini has never found forms of the ordinary Leishmania type either free or enclosed in leucocytes. Professor LAVERAN has examined the preparations and considers the flagellates (herpetomonads) distinct from trypanosomes.

H. B. F.

BRUMPT (E.). **A propos de l'*Haemocystozoön brasiliense* de Franchini.**—*Bull. Soc. Path. Exot.* 1913. June. Vol. 6. No. 6. pp. 377-380. With 3 figs.

Brumpt has examined one smear of *Haemocystozoön brasiliense*, from the blood of FRANCHINI'S patient (see this *Bulletin*, Vol. 2, p. 45) taken some days before death. He has seen all the forms described by FRANCHINI, flagellates excepted. He considers that the name Haemocystozoön should disappear and that the organism should be called *Herpetomonas brasiliense*. The non-flagellate forms of the organism are compared with those of *Trypanosoma cruzi* and those of the flagellate of *Melophagus ovinus*. Brumpt suggested that the development of flagellate forms and of cysts was due to contamination of the preparation outside the body of the host, especially as bacteria were present. This idea was combated by LAVERAN (in whose laboratory FRANCHINI works) who stated that bacteria were present as a very exceptional circumstance in the numerous preparations made by FRANCHINI and hence inferences could not be drawn from the one preparation examined by Brumpt.

A. P.

CHATTON (Edouard). **L'Ordre, la Succession et l'Importance Relative des Stades, dans l'Evolution des Trypanosomides, chez les Insectes.**—*Compt. Rend. Soc. Biol.* 1913. June 6. Vol. 74. No. 20. pp. 1145-1147.

According to the author, in the Trypanosomidae of Insects (series *Leptomonas Crithidia*) the order, succession and characters of the stages are as follows:

1. Monadine stages—flagellate, with blepharoplast anterior to nucleus, and capable of division.
2. Trypanoid stages (in the case of *Leptomonas*) or trypanosomes (in the case of *Crithidia*). Derived from the former by retrogression of the blepharoplast; usually incapable of division; stages of "genetic repose."
3. Gregarine-like phases—monadines which have absorbed their flagella. Immobile, fixed anteriorly to intestinal cells. Form agglomeration rosettes, being capable of division. This is not a stage but an adaptive form.
4. Spermoid stages. Derived from the last-mentioned by retrogression of the blepharoplast. Repose forms, incapable of division. Nucleus and blepharoplast near together. They become
5. Encysted forms, with eosinophile capsule.

Such a complete succession is "diphasic." Simplifications often occur, such as the suppression of the trypanoid or trypanosome stages, when the evolution is said to be "monophasic."

The essential stages are the monadine and spermoid stages.

H. B. F.

MARTIN (C. H.). **Some Remarks on the Behaviour of the Kinetonucleus in the Division of Flagellates: With a Note on *Prowazekia terricola*, a new Flagellate from Sick Soil.** — *Zoologischer Anzeiger.* 1912. March 14. Vol. 41. No. 10. pp. 452-456. With 8 text-figs.

The author first reviews the literature relating to the division of the kinetonucleus or blepharoplast of trypanosomes and trypanoplasms. His own researches on *Trypanoplasma congeri* gave no indication of mitotic division of this organella.

Prowazekia terricola was found in some cultures of a sick soil. It is spindle shaped, measuring 12 μ by 6 μ. No trace of mitotic division has been found in the kinetonucleus. On the contrary, the kinetonucleus swells and is simply constructed into two. Encystment occurs.

The author remarks that whether the kinetonucleus in flagellates is to be regarded as a true nucleus or not is still to him an open question, but that WERBITZKI's work has shown that the old idea of the kinetonucleus regulating the organs of movement is no longer tenable.

The text-figures illustrate the morphological details described in the paper.

H. B. F.

MARTIN (C. H.). **Further Observations on the Intestinal Trypanoplasmas of Fishes, with a Note on the Division of *Trypanoplasma cyprini* in the Crop of a Leech.**—*Quart. Jl. Microsc. Science.* 1913. May. Vol. 59. Pt. 1. (New Ser. No. 233). pp. 175-195. With 2 plates and 2 text-figs.

The author has reinvestigated the flagellate from the stomach of *Box boops*, previously described by LÉGER as *Trypanoplasma intestinalis*, also the flagellate from the stomach of *Cyclopterus lumpus*, and *Trypanoplasma congeri*.

Trypanoplasma congeri shows in normal multiplication, division of the basal granules, splitting first of the anterior flagellum and then of the posterior flagellum and membrane, followed by nuclear division and cytoplasmic cleavage. Abnormal division forms have been found, in which the kinetic nucleus only enters one daughter organism, while the main nucleus, though showing division and ultimately forming two nuclei, remains in the second daughter form. The first of the two forms degenerates; the fate of the second is unknown. Rounding-up forms, similar to those found in some trypanosomes, are also described.

Heteromita dahlii, Apstein, = *Trypanoplasma ventricoli*, Keysselitz, = *Diplomastix dahlii*, Mobius, occurs in *Cyclopterus lumpus*. The organism has marked euglenoid movements. A mouth is present. It has two flagella, the anterior one being much thickened at its base and the posterior one being closely in contact with the body so that no undulating membrane is present. The nuclei vary in appearance. Longitudinal division is described in detail. The parasites are restricted to the stomach of the fish and are immobilised quickly by intestinal juice.

Trypanoplasmoides intestinalis = *Trypanoplasma intestinalis*, Léger, = *Cryptobia intestinalis*, Alexieff, occurs in the stomach of *Box boops*. It shows three flagella in life very clearly. The organism is "roughly carrot shaped," three free flagella originate from its blunter extremity, the fourth turns along the body and ends freely. Division is described, which occurs in the smaller or medium sized forms. Rounded forms, possibly encysting, also are present. Because of its movements, method of division and three anterior flagella, the organism is placed in the genus *Trypanoplasmoides*.

The division of *Trypanoplasma cyprini* in the crop of a leech was seen, chiefly in the later stages.

The author concludes with a comment on the nomenclature of the bimastigate flagellates, the need for a re-investigation of the *Cryptobia* of snails and a protest against the undue importance assigned to the kinetic nucleus which is not necessarily homologous in all flagellates.

A. P.

FRANCHINI (G.). **Sur un Protozoaire nouveau parasite de** *Anopheles maculipennis*.—*Compt. Rend. Soc. Biol.* 1913. June 13. Vol. 74. No. 21. pp. 1196-1198. With 18 text-figs.

The new parasite is rare, having been found in one mosquito out of several hundreds examined. It is described under three different "aspects," thus:—

1. Free parasites, round or oval, about 3·5 μ in diameter, and uninucleate. They are unpigmented.

2. Multiplicative forms, encysted, measuring 8·3 μ to 9·9 μ in diameter, and dividing by a series of bipartitions into eight daughter forms. The latter are ovoid measuring 3·5 μ by 2·5 μ.

3. Encysted forms, round or oval, measuring 4·5 μ to 5 μ by 2·5 μ, with thick cyst wall and large nucleus.

Franchini considers the parasite to be new, and its development to be completed within the digestive tube of *Anopheles maculipennis*. He names the organism *Maccellie anophelie*, n.g., n. sp.

The paper is illustrated by 18 text figures.

H. B. F.

Book Reviews.

Ehrlich (Paul). **Abhandlungen über Salvarsan.** Vol. 3. 584 pp. With 2 plates and 49 text-figs. 1913. Munich: J. F. Lehmann's Verlag. [Price, paper 10 Mk.; cloth 12 Mk.]

This work consists, like the previous two volumes, of reprints of papers published, chiefly in the *Münchener Medizinische Wochenschrift,* on salvarsan and neosalvarsan. There are Sections on Technique (the "water error" and saline fever), The use of salvarsan in Navies and Armies, Abortive treatment of syphilis, Reinfection after treatment, Nerve relapses and Lumbar puncture, Secondary Effects and Deaths, Salvarsan in Non-Syphilitic Diseases (scarlatina, noma, chorea, etc.), Salvarsan in Exotic Diseases, and Neosalvarsan. Articles by Ehrlich introduce and close the volume.

All is of interest to workers in the tropics; the last two sections more particularly concern the readers of this *Bulletin.* Marinestabsarzt Dr. G. Rost writes on Salvarsan in Yaws (pp. 409-413). The cases were seen in the Yaws Hospital at St. Augustine, Trinidad, under the care of Dr. Alston. The salvarsan was given as oil emulsion intramuscularly. Intravenous injections were excluded owing to the lack of the necessary apparatus. The oil emulsion is a simple means of administration. Oil is a bad medium for bacteria, so that there is slight danger of sepsis. There were about 1,000 cases treated; 500 are here considered. The first was treated in January and the last in October, 1911. The average dose was 0·6 gm. for adults, for children up to 0·2 gm. At the end of November 1911 498 cases were cured, that is to say 99·6 per cent., 409 after one injection, 75 after two, and 14 after three injections. Only two cases had failed to be cured and received a third injection. Only four relapses were seen, all of them after one injection; these cases were cured by a second. No complications attributable to the drug were seen, though 75 per cent. of the treated were children. The author thinks that this method of administration is specially suitable in tropical practice for expeditions and in the field.

The work of Caryophyllis and Sotiriades on the treatment of kala azar has been noticed in this *Bulletin,* Vol. 1, p. 6, as that of v. Peterson on the treatment of Tropical Sore (*loc cit.,* p. 372), and that of Hata on treatment of Rat Bite Disease in Japan (*loc cit.,* p. 407).

Iversen and Tuschinsky write on the treatment of tertian malaria with neosalvarsan at St. Petersburg (pp. 497-502). Five cases were treated. Four had previously had quinine. The temperature charts of three are given. The dose was 0·6 gm. to 0·75 gm. given intravenously. They cannot say whether the disappearance of the parasites is permanent. They prefer to give a second dose ten days after the fall of temperature. They consider neosalvarsan to be a specific for benign tertian malaria.

Werner's paper on Neosalvarsan in Malaria was summarised in this *Bulletin,* Vol. 1, p. 120.

A list of 132 references is appended.

A. G. B.

CASTELLANI (Aldo) & CHALMERS (Albert J.). **Manual of Tropical Medicine.** Second Edition. xxxii+1747 pp. With 630 illustrations in text. 1913. London: Baillière, Tindall & Cox. [21*s*. net.]

Published first in April 1910 a second edition of the above work has now appeared. The subject has advanced considerably in that time and an increase of 500 pages has been necessary to deal adequately with the new material. Though no discoveries of a very startling nature nor of great magnitude have been made in the interval yet there have been many smaller ones, and, as already mentioned, the general advance has been a progressive one. With so many nationalities now actively engaged in the study of Tropical Medicine this is not to be wondered at, and a book on the subject, to keep up to date, really requires a new edition at least every three years.

The general arrangement of the new edition follows that of the old, and this is now so well known that it need not be mentioned again here.

The authors have incorporated everything of importance that has happened right up to the moment of going to press, though some of this has not had time to be confirmed and will in all probability require considerable modification in the future. In addition to this insertion of new matter portions of the old text have been corrected where necessary, and everything brought thoroughly up to date. As a text book and as a general book of reference there is no doubt that the manual takes a foremost place amongst the works of tropical medicine of the present day, and the amount of hard work the authors must have accomplished will be thoroughly appreciated by everyone who has a first hand knowledge of the subject. As others have already noticed and pointed out, the index to the general contents and to authors' names contains several mistakes, and it certainly will repay the writers to have this more closely attended to in future editions. Another complaint one has heard is that the size of the book is now too great. Against that however must be put the great advantage of having all one's information in one volume; a great desideratum when moving about and far removed from libraries.

The manual is specially well illustrated, many original drawings, diagrams, photographs and coloured plates being found within its pages, for a number of which the authors are indebted to Signor TERZI, so well known for his skill in delineating insects and other tropical parasites.

G. C. L.

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Compiled by R. L. Sheppard, Librarian.

[Continued from Bulletin, Vol. 1, pp. 591–618.]

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The Annual Subscription for the Tropical Diseases Bulletin is TWENTY-ONE SHILLINGS post free.

Subscriptions should be sent to Messrs. BAILLIÈRE, TINDALL and COX, 8, Henrietta Street, Covent Garden, London, W.C., who are also the advertisement agents.

The Bulletin appears as a rule twice a month.

Cloth cases for binding the Bulletin can be obtained from Messrs. BAILLIERE, TINDALL and COX, price One Shilling and Sixpence post free.

The Tropical Diseases Bureau publishes also the TROPICAL VETERINARY BULLETIN, quarterly, Annual Subscription Ten Shillings, single numbers Three Shillings post free; to be obtained from the above agents.

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Nos. 6 and 7 of the Bulletin will be issued on August 30 and September 30 respectively.

The TITLE PAGE and INDEX of Volume I, which closed with Bulletin No. 12, are being prepared and will be issued shortly.